

EPA ORD Research Budget Sections For 2009 –
Ecosystems, Water and Security

ORD's Homeland Security: Preparedness, Response, and Recovery
Program/Project Resources by Research Area
(Dollars in Millions)

ORD Long-Term Goal	FY 2004 Enacted		FY 2005 Enacted		FY 2006 Enacted		FY 2007 Enacted		FY 2008 President's Budget		FY 2008 Enacted ¹		FY 2009 President's Budget		FY 2009 vs. FY 2008 Enacted	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
Decontamination and Consequence Management	\$8.3	21.9	\$2.1	4.6	\$11.7	23.3	\$14.7	23.6	\$14.8	23.5	\$12.7	23.5	\$16.5	23.7	\$3.8	0.2
Water infrastructure Protection	\$11.6	10.7	\$11.5	20.1	\$9.9	15.8	\$10.7	15.6	\$10.8	15.6	\$10.7	15.6	\$10.7	15.3	\$0.0	(0.3)
Threat and Consequence Assessment	\$10.0	6.3	\$11.0	15.7	\$10.1	11.8	\$10.2	11.7	\$10.1	11.8	\$9.9	11.8	\$12.4	18.5	\$2.5	6.7
Total	\$29.9	38.9	\$24.6	40.4	\$31.7	50.9	\$35.6	50.9	\$35.7	50.9	\$33.3	50.9	\$39.6	57.5	\$6.3	6.6

Note: Includes estimates of workforce support costs

¹ Reflects estimate of the FY 2008 Enacted.

Homeland Security: Preparedness, Response, and Recovery

Program Area: Homeland Security

Goal: Clean Air and Global Climate Change

Objective(s): Radiation

Goal: Healthy Communities and Ecosystems

Objective(s): Chemical and Pesticide Risks; Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
Environmental Program & Management	\$3,394.3	\$3,381.0	\$3,329.0	\$3,412.0	\$83.0
<i>Science & Technology</i>	<i>\$39,003.6</i>	<i>\$40,768.0</i>	<i>\$38,193.0</i>	<i>\$46,210.0</i>	<i>\$8,017.0</i>
Hazardous Substance Superfund	\$50,318.1	\$45,280.0	\$44,629.0	\$56,676.0	\$12,047.0
Total Budget Authority / Obligations	\$92,716.0	\$89,429.0	\$86,151.0	\$106,298.0	\$20,147.0
Total Workyears	166.7	167.6	167.6	174.2	6.6

Program Project Description:

Through research, development, and technical support activities, EPA’s Homeland Security Research Program enhances the Nation’s preparedness, response, and recovery capabilities for homeland security large-scale catastrophic incidents involving chemical, biological or radiological threats and attacks. EPA continues to assemble and evaluate tools and capabilities so that cost effective response approaches can be identified and evaluated for future use by the response community, elected and appointed decision makers, risk managers, and the public. Research will provide state-of-the-art approaches to address all phases of emergency response to ensure public and worker safety, protect property, and facilitate recovery to a safe state and resumption of normal activity. The Agency also continues to work with other Federal agencies and other organizations, through collaborative research efforts, to strengthen decontamination capabilities.

FY 2009 Activities and Performance Plan:

EPA homeland security research on chemical, biological, and radiological (CBR) contaminants will continue to fill critical gaps in our ability to effectively respond to and recover from threats, attacks, and large-scale catastrophic incidents. It will promote improved response capabilities and more informed decision making across government and industry in areas where EPA has unique knowledge and expertise related to decontamination and disposal of contaminated materials.

The goal of the FY 2009 Homeland Security Research Program is to deliver science and engineering research results to the program’s customers to better facilitate and enable their ability to carry out their homeland security missions. Needs identified jointly with key customers are the primary factor used in prioritizing the research program’s activities. Key

customers include EPA's Water Program, the Solid Waste and Emergency Response Program, and the Air Program. The research program will provide support and assist in interactions with water utilities to help ensure the security of the nation's water systems and safe drinking water. The research program is also increasing its responsiveness to the science needs of the EPA emergency response community (National Decontamination Team, Environmental Response Team, Radiological Emergency Response Team, Removal Managers, and On-Scene Coordinators). Research will be focused on providing tools and support to facilitate response to and recovery from large-scale catastrophic incidents. Along with this customer focus, the program has enhanced its communications throughout EPA's Homeland Security program and the Regional offices to ensure that needs are met and communicated and that areas of collaboration have been identified.

Decontamination Research:

EPA's decontamination research program directly supports EPA's National Response Plan (NRP) as well as the responsibilities assigned to the Agency in Homeland Security Presidential Directives (e.g., HSPD-7, HSPD-9, and HSPD-10). In many cases, the research program also supports the Department of Homeland Security's requirements for EPA expertise in a number of key areas including water infrastructure and materials decontamination and disposal. Activities in FY 2009 will include the following:

- Threat and consequence assessment research will focus on developing products and tools (such as filling critical gaps in toxicity databases) to provide information for rapidly assessing threats and risks to human health, aid decision-makers in assessing risks to human health from biological and chemical agents, and further identify research gaps. The information to be collected, generated, and evaluated includes information on the toxicity, infectivity, mechanism of action, fate, transport, and exposure consequences for biological agents. This information will be used to develop relationships of human response to varying doses of biological units (spores, cells, etc.) to assist in the development of cleanup goals. Research will continue to identify risks during incidents and to develop improved methods to communicate those risks to decision-makers and the public.
- EPA will continue to develop innovative methods and strategies and test commercially-available technologies to enhance the Nation's ability to detect, contain, decontaminate, and safely dispose of CBR warfare agents resulting from terrorist attacks in outdoor areas such as urban centers.
- To support the homeland security requirements under HSPDs 9 and 10, including the development of the Environmental Laboratory Response Network (ELRN), EPA will continue to expand the Standardized Analytical Methods (SAM) and create Reference Laboratory capability. SAM identifies high risk chemical, biological, and radiological agents and analytical methods for the ELRN that are required to document safe restoration exposure levels. Reference Labs serve as an authoritative source in the ELRN for method development, verification, and validation.

In addition, EPA plans to enhance the nation's ability to respond to a wide-area anthrax attack (i.e., an intentional anthrax release outdoors, in an airport, train station, or stadium). Increased resources are requested to strengthen research in the following areas:

- Development and adaptation of methods to test for anthrax including the extent of contamination and clearance following wide-area decontamination.
- Determination of deposition and adhesion properties of anthrax and its ability to re-aerosolize from materials common to wide-area settings.
- Development of methods to effectively decontaminate anthrax in wide area environments while minimizing the generation of waste.
- Development and adaption of methods and models for hazard and exposure assessments needed to determine risk-based clean up goals for anthrax.

Decontamination research will produce many science and engineering products in FY 2009 to support EPA's National Response Plan and first-responders in carrying out their homeland security missions. The following are several FY 2009 product highlights:

- Methods for real-time detection of anthrax and for rapid determination of its viability on surfaces and in environmental media.
- Report on the ability of anthrax to re-aerosolize from various wide-area materials.
- Methods to combine infectivity and exposure assessments into a scientifically defensible characterization of risk of humans exposed to anthrax.
- Conduct a full-scale demonstration of decontamination technologies shown to be efficacious in lab studies.
- Update *Support for Environmental Rapid Risk Assessment (SERRA)* database with the latest information on the effects to human health from bioterrorism and other warfare agents.
- Provisional Advisory Levels (PALs) for 15 chemicals to guide responders on human health risk of exposure to toxic industrial chemicals and chemical warfare agents.
- Expand *Disposal Decision Support Tool* to include guidance for the safe disposal of radioactive wastes and wastes from agroterrorism.

Water Infrastructure Protection Research:

Water Infrastructure Protection Research will focus on developing, testing, demonstrating, communicating, and implementing enhanced methods for detection, treatment, and containment of CBR agents and bulk industrial chemicals intentionally introduced into drinking water and wastewater systems. This is consistent with the Critical Infrastructure Protection Plan (CIPP) developed for water infrastructure and with the *Water Security Research and Technical Support Action Plan*. The program will produce many science and engineering products in FY 2009 to support EPA's Water Program and water utilities in carrying out their homeland security missions. The following are several FY 2009 product highlights:

- Computer tools to assess water utility vulnerabilities, optimally place sensors, and help to manage consequences of both terror and non-terror events.
- Cost effective online Total Organic Carbon (TOC) detector, essential to real-time monitoring of distribution systems.
- Decontamination approaches for water distribution systems
- Validated chemical Standard Analytical Protocols (SAP) for water.

Safe Buildings Research:

EPA's Safe Buildings research focuses on identifying, developing, and testing better, less expensive, and safer decontamination methods to facilitate building reoccupancy after a terrorist attack involving CBR agents. This research also involves developing procedures to use before and after an attack that would minimize the spread of contaminants inside a building, protect building occupants, and limit the area needing decontamination. An indoor contamination event typically results in a significant quantity of building decontamination residue and this research also addresses safe disposal of these residues. The program will produce science and engineering products in FY 2009 to support EPA's National Response Plan and first-responders in carrying out their homeland security missions. The following are FY 2009 product highlights:

- Performance information on commercially-available biological decontamination technologies to assist decision making on cleanup following an attack.
- Strategies to contain fumigants used in the decontamination of buildings.

Radiation Monitoring:

In the Nuclear/Radiological Incident Annex to the National Response Plan for Homeland Security, EPA's responsibilities include maintenance and enhancement of the RadNet air monitoring network. The network includes deployable monitors and near real-time stationary monitors. EPA also is responsible for maintenance of both fixed and mobile monitors, and personnel and asset readiness for radiological emergency responses, which includes participating in emergency response situations and providing technical expertise and support.

The Agency will continue to upgrade and expand the RadNet air monitoring network. These near real-time monitors will replace or augment the pre-existing system of 60 conventional air samplers. Fixed stations will operate routinely and in conjunction with as many as 40 deployable monitors following a radiological incident. Through FY 2009, EPA expects to install at least 100 monitors providing near real-time radiation monitoring coverage for over two-thirds of the most populous U.S. cities. As the RadNet air monitoring network is upgraded and expanded, response time and data dissemination will be reduced from days to hours and will provide the Agency and first responders with greater access to data, improving officials' ability to make decisions about protecting public health and the environment during and/or after an incident. Additionally, the data will be used by scientists to better characterize the effect of a radiological incident.

Improve National Radiological Lab Capacity and Capability:

In FY 2009, EPA will build upon work begun in FY 2006 to augment EPA’s existing radiological laboratory to meet emerging homeland security needs and serve as the Agency’s radiological reference laboratory. EPA will continue to upgrade the Agency’s laboratory response capability which will include a network of “go-to” state laboratories to ensure a minimal level of surge capacity for radiological terrorism incidents; enhance the existing capability to conduct chemical and radiological analysis simultaneously; and coordinate the Radiological Emergency Response Team’s sample handling protocols with the mobile triage units. Additionally, EPA will align and integrate related radiological activities with existing National Lab Networks. The Agency will continue a pilot project, begun in FY 2007, to improve state radiological laboratory capacity through provision of additional laboratory instruments, training, quality assurance testing, and audits of the selected state laboratories. EPA will continue to do audits and performance evaluation studies to assess and continually improve laboratory competency. As additional laboratories are audited, the number of available core laboratories that can support the Agency will increase. In addition, a template for a common radiological electronic data deliverable will be developed. This will help to ensure that the laboratories report the data in a common format, making the compilation of data from various laboratories more efficient.

Biodefense:

EPA will continue work to develop and validate methods to evaluate the efficacy of antimicrobial products against bioterrorism agents, expanding this work to address unique formulations, additional surface types, and additional bioterrorism agents and emerging pathogens. The Agency will address critical gaps in efficacy test methodology and knowledge of microbial resistance. In addition to vegetative bacteria, in FY 2009, EPA will address threatening viruses and other emerging pathogens in environmental media. EPA will invest in the development and evaluation of efficacy test protocols for products designed to control viruses in the environment during decontamination. The development of “decon toolboxes” for specific bioterrorism agents or classes of bacteria/viruses will continue into FY 2009.

In order to improve the Agency’s ability to respond to events involving biothreat agents, EPA will increase the number of standardized and validated methods for evaluating the efficacy of decontamination agents. EPA will continue to seek independent third-party analysis for method validation efforts through recognized standard setting organizations. As new methods are developed, statistical modeling for various biodefense scenarios will be critical to the development of science based performance standards. Microbial persistence, resistance to antimicrobial agents, and an understanding of biofilm environments are also key factors in evaluating the efficacy of decontamination tools.

Performance Targets:

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of water security initiatives.			100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	% of planned outputs delivered in support of support risk assessors and decision-makers in the rapid assessment of risk and the determination of cleanup goals and procedures following contamination			100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of efficient and effective clean-ups and safe disposal of contamination wastes.			100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of establishment of the environmental National Laboratory Response Network			100	100	Percent

Work under this program supports multiple strategic objectives. In FY 2009, the program plans to meet its targets of completing and delivering 100% of its planned outputs in support of: 1) the efficient and effective clean-up and safe disposal of decontamination wastes, 2) the Water Security Initiative, 3) the rapid assessment of risk and the determination of clean-up goals and procedures following contamination, 4) the establishment of the National Laboratory Response Network, and 5) validated standardized methods for evaluating efficacy of antimicrobial products against a variety of biological pathogens. In achieving these targets, the program will contribute to EPA's goal of providing scientifically sound guidance and policy decisions related to the health of people, communities, and ecosystems.

EPA is on track through its ongoing work to meet its 2011 strategic plan goal of protecting public health and the environment from unwanted releases of EPA regulated radioactive waste and to minimize impacts to public health from radiation exposure. EPA has developed new outcome-oriented strategic and annual performance measures for this program in conjunction with its 2007 PART assessment. The Radiation Program received a rating of "moderately effective." The Office of Management and Budget provided two follow-up recommendations to the program. The first was for the program to develop an efficiency measure that demonstrates that the program utilizes total resources efficiently; this has been done. The second recommendation encourages EPA to explore where the RadNet environmental monitoring program best fits programmatically, in consultation with the Department of Homeland Security.

Beginning in 2006, EPA's Homeland Security Research Program has been assessed by OMB's PART as a component of other research program reviews.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (+\$826.0) This reflects an increase for payroll and cost of living for all FTE.
- (+\$4,500.0) This reflects an increase to biodefense research related to anthrax including sampling, decontamination, and risk assessment methods and models to aid first responders in determining the extent of an outdoor release of anthrax as well as to aid in the identification of appropriate decontamination options.
- (+\$500.0) EPA's pesticide decontamination program will focus on reducing gaps in laboratory networking and analytical capabilities related to biodefense research.
- (+\$503.0 / +6.6 FTE) The majority of these FTE are a redirection from the Drinking Water Research program to provide support for the development of provisional advisory levels (PALs). This work will help to reduce uncertainty in the PAL determinations, validate key assumptions made in the absence of data, and identify and/or address key data gaps and research needs. Effects research associated with the Four Lab Study (a study of the effects of disinfection by-product [DBP] mixtures produced during water treatment using chlorination) is approaching completion and publication, so FTE previously active in this area can support the PAL efforts.
- (-\$100.0) This reduction reflects completion of certain activities associated with increasing laboratory capability and capacity, such as acquiring updated radiological

monitoring equipment and constituting, equipping, and deploying two radiation response teams.

- (+\$1,100.0) This increase provides funding for accelerated radiological threat agent analyses through increased lab and sampling capacity/capability. With increased funding, EPA will be able to respond to the next level of preparedness by being able to more effectively respond to multiple events. EPA will demonstrate results through field scale decontamination demonstrations and by increasing radiological sample throughput.
- (+\$688.0) This change reflects restoration of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs.

Statutory Authority:

Atomic Energy Act of 1954, as amended, 42 U.S.C. 2011 et seq. (1970), and Reorganization Plan #3 of 1970; CAA; CERCLA; SARA; Executive Order 12241 of September 1980, National Contingency Plan, 3 CFR, 1980; Executive Order 12656 of November 1988, Assignment of Emergency Preparedness Responsibilities, 3 CFR, 1988; Public Health Service Act, as amended, 42 U.S.C. 201 et seq.; Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, 42 U.S.C. 5121 et seq.; SDWA; Title XIV of the National Defense Authorization Act of 1997, PL 104-201 (Nunn-Lugar II) National Response Plan; Public Health Security and Bioterrorism Emergency and Response Act of 2002; TSCA; Oil Pollution Act; Pollution Prevention Act; RCRA; EPCRA; CWA; FIFRA; Federal Food, Drug and Cosmetic Act; FQPA; Ocean Dumping Act; Public Health Service Act, as amended; 42 U.S.C. 201 et seq.; Executive Order 10831 (1970); Public Law 86-373; PRIA.

Homeland Security: Preparedness, Response, and Recovery

Program Area: Homeland Security
Goal: Land Preservation and Restoration
Objective(s): Restore Land

Goal: Healthy Communities and Ecosystems
Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
Environmental Program & Management	\$3,394.3	\$3,381.0	\$3,329.0	\$3,412.0	\$83.0
Science & Technology	\$39,003.6	\$40,768.0	\$38,193.0	\$46,210.0	\$8,017.0
<i>Hazardous Substance Superfund</i>	<i>\$50,318.1</i>	<i>\$45,280.0</i>	<i>\$44,629.0</i>	<i>\$56,676.0</i>	<i>\$12,047.0</i>
Total Budget Authority / Obligations	\$92,716.0	\$89,429.0	\$86,151.0	\$106,298.0	\$20,147.0
Total Workyears	166.7	167.6	167.6	174.2	6.6

Program Project Description:

EPA's Homeland Security Emergency Preparedness and Response program develops and maintains an agency-wide capability to respond to large-scale catastrophic incidents with emphasis on those that may involve Weapons of Mass Destruction (WMD). The program builds upon EPA's long-standing emergency response and removal program, which is responsible for responding to and cleaning up both oil and hazardous substance releases. EPA's homeland security effort expands these responsibilities to include threats associated with Chemical, Biological, and Radiological (CBR) agents. Over the next several years, the Agency will continue to focus on building the capacity to respond to multiple simultaneous large-scale catastrophic incidents. To meet this challenge, EPA will continue to use a comprehensive approach that brings together all emergency response assets to implement efficient and effective responses. Another priority for this program is improving research, development, and technical support for potential threats and response protocols.

FY 2009 Activities and Performance Plan:

In FY 2009, efforts to develop the capability to respond to multiple incidents will concentrate on four key areas: 1) maintaining a highly skilled, well-trained and equipped response workforce that can rise to the challenge of responding to simultaneous incidents as well as threats involving WMD substances; 2) continuing the development of decontamination options, methods, and protocols to ensure that the nation can quickly recover from nationally significant incidents; 3) operating and maintaining a nationwide environmental laboratory network capability to enhance coordination and standardization of laboratory support which includes expanding Agency Chemical Warfare Agent (CWA) fixed and field capabilities; and 4) implementing the EPA's

National Approach to Response (NAR) to effectively manage EPA's emergency response assets during large-scale activations. EPA activities in support of these efforts include the following:

- Develop and maintain the skills of EPA's On-Scene Coordinators (OSCs) through specialized training, exercises, and equipment. In FY 2009, EPA and its Federal, state, and local homeland response partners will continue to develop and participate in a wide range of exercises and trainings designed to test EPA's response capabilities. EPA will continue procurement of upgrades of specialized response equipment and will ensure maintenance of equipment purchased in prior years for OSCs.
- In an effort to strengthen its responder base during large-scale catastrophic incidents, EPA will provide training to volunteers of the Response Support Corps (RSC) and/or as part of an Incident Management Team (IMT). These volunteers provide critical support in Headquarters and Regional Emergency Operations Centers and in assisting with operations in the field. To ensure technical proficiency, this new cadre of response personnel requires initial training and yearly refresher training to include exercises, workshops, health and safety training, medical monitoring, and equipment acquisition, as necessary. EPA currently has about 800 trained RSC and IMT members and estimates it will need between 3,000 and 3,500 members to respond to five INS. The proposed funding will allow the Agency to train a minimum of 700 volunteers to meet RSC and IMT requirements.
- Continue to accelerate current efforts to build laboratory capacity and capability to analyze, verify, and validate CWA samples during an INS. The Agency will maintain and operate existing fixed CWA labs and Portable High-Throughput Integrated Laboratory Identification System (PHILIS) units. A recent analysis has shown a substantial gap between the Agency's current capacity and what may be needed to analyze chemical and biological warfare agents. To continue to make progress towards reducing that gap, EPA will purchase two additional PHILIS units to enhance the Agency's mobile analytical capability for CWA and also will award three additional grants and/or interagency agreements to state and/or Federal agencies for fixed CWA labs to increase capacity. Working with the Department of Homeland Security (DHS), the Department of Defense, and the states, EPA will implement standard operating procedures and standards of performance. The Agency will continue to actively participate with the Integrated Consortium of Laboratory Networks, maintaining and updating a laboratory compendium of Federal, state and commercial capabilities, and maintain a chemical surety program. EPA also will work with DHS to implement a competitive state grant for an All Hazards Receipt Facility.
- Headquarters and Regional Offices also will operate and maintain the Environmental Laboratory Response Network (eLRN) to provide lab analysis for routine and emergency response operations including a terrorist attack. In addition, in FY 2009, EPA plans to enhance the eLRN through the improvement of an electronic data deliverable for use by all eLRN laboratories.

- Continue to develop and validate environmental sampling, analysis, and human health risk assessment methods for known and emerging biological threat agents in accordance with Homeland Security Presidential Directive-10. These sampling and analysis methods are critical to ensuring appropriate response and recovery actions and developing necessary laboratory support capacity. The human health risk assessment methods also are extremely important to decision makers who are faced with determining when decontaminated facilities and equipment can be returned to service. This decontamination and consequence management research will produce data, information, and technologies to assist EPA in developing standards, protocols, and capabilities to recover from and mitigate the risks associated with biological attacks.
- Implement the NAR to maximize Regional interoperability and to ensure that EPA's OSCs will be able to respond to terrorist threats and large-scale catastrophic incidents in an effective and nationally consistent manner.
- Procure and operate an additional Airborne Spectral Photometric Environmental Collection Technology (ASPECT) plane. The ASPECT provides aerial assistance to first responders by rapidly collecting and processing chemical, visible, and radiological information quickly and relaying the information directly to the command structure during an INS. This technology has been used to assist the response community in over 50 incidents from ammonia releases to the recent Gulf Coast hurricanes. The existing ASPECT plane is located in the center of the country and takes a minimum of three hours to approach east and west coast targets which means any chemical or biological data collected from plume will not include critical environmental information near the time of the release. EPA proposes to locate the additional aircraft on the East Coast which will reduce response times for acquiring real-time monitoring capabilities in the Region and improve EPA's sampling and analysis efforts by expanding the geographic coverage.
- Develop the Rapidly Deployable Chemical Defense System (RDCDS) program, an interagency strategy to enhance the Airborne Spectral Photometric Environmental Collection Technology (ASPECT) program. RDCDS consists of both a ground and airborne component. The ground component is being developed at a national lab and the airborne component consists of the EPA ASPECT team. The RDCDS program will accelerate the development of an automated chemical compound identification. Automating compound identification involves the collection of field and laboratory data on individual chemical compounds. This data is then used to generate chemical compound filters which can be used in the rapid identification of the compound from the large data sets collected during a response. These data points can then be rapidly marked and geo-located by cross referencing to Global Positioning System (GPS) data sets. This development effort will significantly increase the speed with which chemicals can be identified, verified, mapped, and the data transmitted to first responders.
- Improve and enhance Agency systems to accept a wider variety of environmental data, including sampling, monitoring, hazardous debris and facilities reconnaissance, and to make these data easily and rapidly accessible for a variety of uses. Implementation of these activities will create a seamless data flow from the field and laboratory to the

various Incident Command System (ICS) units and to the general public. It also will improve EPA's ability to make rapid and accurate response decisions and to keep the public informed of health and environmental risks.

- Maintain and improve the Emergency Management Portal (EMP). FY 2009 will be the first year for complete integration of the basic management modules (i.e., environmental assessment, equipment, personnel, and decontamination). EPA will continue to manage, collect, and validate new information including the portfolio content for new and existing WMD agents as new decontamination techniques are developed or as other information emerges from the scientific community.
- Maximize the effectiveness of EPA's involvement in national security events through pre-deployments of assets such as emergency response personnel and field detection equipment. Pre-deployments allow immediate response should an incident occur at a national security event. EPA estimates it will participate in three pre-deployments in FY 2009.
- Conduct one WMD Decontamination Course for EPA OSCs, Special Teams, and Response Support Corp personnel to improve decontamination preparedness for biological, chemical, and radiological agents.

Performance Targets:

Work under this program supports multiple strategic objectives. Currently, there are no performance measures for this specific Program.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (+\$633.0) This reflects an increase for payroll and cost of living for existing FTE.
- (+\$3,500.0) This increase will allow EPA to accelerate efforts to build laboratory capacity and capability to analyze, verify, and validate samples during an INS. Funding will support two grants and/or IAGS to States and/or Federal agencies to build analytical capacity for chemical warfare agents and procure a PHILIS unit to enhance the Agency's mobile analytical capability for CWA.
- (+\$2,200.0) This increase funds training for Response Support Corps and Incident Management Team volunteers who provide critical support in Headquarters and Regional Emergency Operations Centers and also assist with operations in the field during large-scale catastrophic incidents.
- (+\$3,000.0) This increase funds the procurement of an additional Airborne Spectral Photometric Environmental Collection Technology (ASPECT) airplane to be located on the East Coast which will reduce the response time for acquiring real-time monitoring capabilities during large-scale catastrophic incidents.

- (+\$500.0) This increase will improve and enhance emergency response data systems to allow for a seamless data flow from the field and laboratory to Incident Command System units and to the general public.
- (+\$1,460.0) This increase will fund Regional homeland security training opportunities, participation at agency and interagency exercises designed to better prepare for a large-scale catastrophic incident, and associated travel to support the Regions' emergency response duties.
- (+\$754.0) This change reflects restoration of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs. This increase will support Regional emergency preparedness activities.

Statutory Authority:

CERCLA Sections 104, 105, 106; Clean Water Act; Oil Pollution Act.

Research: Drinking Water Program/Project by Research Area

(Dollars in Millions)

	FY 2004 Enacted		FY 2005 Enacted		FY 2006 Enacted		FY 2007 Enacted		FY 2008 President's Budget		FY 2008 Enacted ²		FY 2009 President's Budget		FY 2009 vs. FY 2008 Enacted	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
ORD Long-Term Goal																
Regulated Contaminants	\$18.0	71.3	\$22.6	72.5	\$18.7	71.0	\$17.0	69.8	\$17.9	69.3						
Unregulated Contaminants	\$21.3	121.5	\$22.4	121.4	\$23.0	119.6	\$25.1	119.8	\$24.0	119.0						
Distribution systems and source water protection	\$4.8	21.3	\$3.7	21.8	\$3.5	19.0	\$6.2	19.1	\$6.7	18.9						
Characterize risks associated with drinking water sources, treatment, distribution, and use ¹											\$12.6	66.5	\$10.1	54.4	(\$2.5)	(12.1)
Control, manage, and/or mitigate potential health risks ¹											\$36.2	140.7	\$35.1	135.8	(\$1.1)	(4.9)
Total	\$44.1	214.1	\$48.7	215.7	\$45.2	209.6	\$48.3	208.6	\$48.5	207.2	\$48.8	207.2	\$45.3	190.2	(\$3.5)	(17.0)

Note: Includes estimates of workforce support costs

¹ In FY 2009, ORD revised its Long Term Goal structure within the Drinking Water program. This was made retroactive to the FY 2008 Enacted.

² Reflects estimate of the FY 2008 Enacted.

Research: Drinking Water
 Program Area: Research: Clean Water
 Goal: Clean and Safe Water
 Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
<i>Science & Technology</i>	<i>\$44,342.9</i>	<i>\$48,548.0</i>	<i>\$48,775.0</i>	<i>\$45,283.0</i>	<i>(\$3,492.0)</i>
Total Budget Authority / Obligations	\$44,342.9	\$48,548.0	\$48,775.0	\$45,283.0	(\$3,492.0)
Total Workyears	202.1	207.2	207.2	190.2	-17.0

Program Project Description:

EPA's Drinking Water Research Program provides sound scientific approaches for ensuring safe and sustainable drinking water through integrated, multidisciplinary applied research. This program provides methodologies, data, tools, models, and technologies in support of health risk assessments and other needs pertaining to regulatory decisions under the Safe Drinking Water Act's (SDWA) statutory requirements. Research also is targeted at implementation of regulatory decisions, addressing simultaneous compliance issues, promoting the sustainability of water resources, the reliable delivery of safe drinking water, and developing approaches to improve water infrastructure. The program is designed around the water cycle and the research is organized around five theme areas (assessment tools, source water protection, treatment strategies, distribution/storage/infrastructure, and exposure/health effects). This structure provides opportunities for integrating method development with health effects research and applications in treatment technologies and water distribution systems.

Research in the Drinking Water Research Program is coordinated with the Agency's regulatory activities and timelines. Current research topics include revisions to the Total Coliform Rule (TCR) and implementation of recent regulatory decisions including the Ground Water Rule, the Stage 2 Disinfection Byproduct Rule (DBP2), and the Long-Term 2 Enhanced Surface Water Treatment Rule (LT2). Research is also targeted at supporting the Underground Injection Control (UIC) regulations that pertain to geologic sequestration of carbon. Another major component of the research program is addressing the information gaps associated with chemicals and microorganisms that are on the Contaminant Candidate List (CCL). Several peer-reviewed research strategies^{30,31} and guidance from external experts^{32,33,34,35} have provided input and

³⁰ U.S. EPA, Office of Research and Development. *Research Plan for Microbial Pathogens and Disinfection By-Products in Drinking Water*. EPA 600-R-97-122, Washington, D.C.: U.S. Government Printing Office (1997).

³¹ U.S. EPA, Office of Research and Development. *Research Plan for Arsenic in Drinking Water*. EPA 600-R-98-042, Washington, D.C.: U.S. Government Printing Office (1998).

³² National Research Council. *Classifying Drinking Water Contaminants for Regulatory Consideration*. Washington, D.C.: The National Academies Press (2001).

³³ National Academies of Science. *From Source Water to Drinking Water: Workshop Summary*. Washington, D.C.: The National Academies Press (2004).

guidance for charting the research directions. The Agency also maintains a Drinking Water Research Program (DWRP) Multi-Year Plan³⁶ (MYP) that outlines steps for meeting these needs and annual performance goals and measures for evaluating progress. The Agency is currently revising the drinking water MYP to reflect anticipated science and regulatory needs in FY 2009 and beyond. These plans are subjected to rigorous peer review³⁷ and address high priority research questions related to the safety of drinking water and the safety, reliability, and sustainability of drinking water infrastructure.

In 2007, the Drinking Water research program underwent a mid-cycle progress review by the Board of Scientific Counselors (BOSC), a Federal advisory committee comprised of qualified, independent scientists and engineers.³⁸ The BOSC was “favorably impressed” with the program’s revised structure and concluded that the formation of five thematic areas (i.e. Assessment tools, Source water/Water resources, Treatment/Residuals, Distribution/Storage, Water use/Health effects/Health outcomes) “allows focus on statutory requirements such as the 6-year review or the Contaminant Candidate List with the flexibility to address emerging drinking water research issues such as nanotechnology”. The Drinking Water research program is adopting specific BOSC recommendations, including identifying opportunities for collaboration and resource leveraging while continuing to plan anticipatory drinking water research.

FY 2009 Activities and Performance Plan:

In FY 2009, the Drinking Water research program will focus on characterizing and managing health risks associated with the sources, production and distribution of drinking water for public water supplies. The research plan reflects a progressive shift from addressing single contaminants towards developing exposure and health effects information that can be applied to classes of contaminants. The thematic areas of the program are: assessment tools, source water protection, treatment strategies, water distribution/storage/infrastructure systems, and exposure/health effects. Anticipated research products include:

Assessment tools: Research is focused on developing tools for the analysis, monitoring, screening and prioritization of drinking water constituents. Research will continue to develop methods to measure CCL chemicals and pathogens to assist in assessing occurrence under Unregulated Contaminant Monitoring Rules and for evaluating the effectiveness of treatment techniques. Exposure biomarkers for use in exposure and epidemiology studies, as well as

³⁴ National Research Council. *Indicators for Waterborne Pathogens*. Washington, D.C.: The National Academies Press (2004).

³⁵ National Research Council. *Public Water Supply Distribution Systems: Assessing and Reducing Risks--First Report*. Washington, D.C.: The National Academies Press (2005).

³⁶ U.S. EPA, Office of Research and Development, Drinking Water Research Program Multi-Year Plan. Washington, D.C. Available at: <http://www.epa.gov/osp/myp.htm>.

³⁷ Science Advisory Board. *Review of EPA’s 2003 Draft Drinking Water Research Program Multi-Year Plan* (2005). Available at: <http://www.epa.gov/sab/pdf/sab-05-008.pdf>.

³⁸ U.S. EPA, Board of Scientific Counselors. *Mid-Cycle Review Of The Office Of Research And Development’s Drinking Water Research Program At The U.S. Environmental Protection Agency*. (Washington: EPA, 2007). Available at: <http://www.epa.gov/OSP/bosc/pdf/dwmc082007rpt.pdf>

measurement methods (recovery, viability, speciation) will be improved for compliance monitoring and CCL classification and prioritization. Specific projects include:

- Optimization and characterization of an integrated sample collection, concentration, purification and detection for real-time quantitative detection methods for CCL related organisms.
- Evaluation of the virulence factor activity relationships (VFARs) for characterizing CCL pathogens.

Source Water Protection: Protection of surface water and ground water sources of drinking water requires reliable monitoring methods coupled with implementation of best management practices (BMPs). In addition to watershed research, protection of ground water sources will be a focus in FY 2009 with an emphasis on underground injection control (UIC), aquifer storage and recovery (ASR), and ground water recharge. Research will be directed towards answering key questions associated with minimizing risks of geologic sequestration of carbon on underground sources of drinking water (USDW). Projected research products include:

- Report on molecular microarrays for detection of non-pathogenic bacteria and bacterial pathogens in drinking water source waters.
- State-of-the-science report on real-time early warning systems for source water protection.
- Studies on ASR on the safety of drinking water and the impacts of subsurface CO₂ storage on drinking water quality.

Treatment Strategies: The emphasis of the research will be on evaluating existing treatment strategies for control of CCL contaminants, development of point-of-use/point-of-entry systems for small systems, and simultaneous compliance issues. Research products include:

- Synthesis of information on arsenic removal technologies.
- Improved detection method(s) for CCL-related chemicals for use in Unregulated Contaminant Monitoring Regulations.

Distribution/Storage/Infrastructure: Significant efforts will be focused on distribution systems. Studies will be conducted to better understand the growth and colonization of pathogens in distribution systems. The conditions promoting contaminant releases, such as arsenic and lead, from distribution systems and treatment residuals will be characterized. Research started in FY 2007 under the "Water Infrastructure for the 21st Century" Initiative, will continue in 2009 and will include focusing on field investigations and modeling of how distribution system characteristics (age, materials, capacity) and management/operation practices (flushing, pressure, hydrodynamics, storage, mixing of water sources, corrosion control) impact biofilms, water chemistry, corrosion, and drinking water quality. The Agency will explore integrated approaches for managing and assessing risks in the distribution system and the development of innovative, real-time condition assessment, technology, repair or rehabilitation techniques. Research products will report on advanced condition assessment for drinking water mains.

Exposure/Health Effects: A major research focus is clarifying potential health effects of CCL contaminants, waterborne disease outbreak analysis, and epidemiological studies, including the potential exposure and health significance of newly identified regulated disinfection byproducts (DBPs) and mixtures of DBPs, particularly from the use of alternatives to chlorine disinfection. Specific research products include:

- Health effects associated with alternative disinfection processes and their byproducts.
- Epidemiology study on the illness rate for untreated groundwater and distribution systems.

Within the 5 general thematic areas outlined above, the Drinking Water research program will continue to provide support for the SDWA-mandated 6-year review of regulated contaminants (e.g., draft revision of the Total Coliform Rule). Research on health-effects associated with arsenic and DBPs will be winding down. On-going work from the arsenic demonstration program will be synthesized in terms of case study costs and performance results. Results from the comprehensive four-lab study on DBPs will be disseminated. Bench and pilot scale research on simultaneous compliance issues resulting from the Ground Water Rule and the Enhanced Surface Water Treatment Rule will be continued. Modeling and field studies will be initiated to address UIC research needs associated with geologic sequestration of carbon.

By conducting research in support of SDWA, this research program will assist the Agency in pursuing its strategic objective of providing, by 2011, drinking water that meets all applicable health-based drinking water standards to 91 percent of the population served by community water systems.

The Office of Management and Budget (OMB) rated the program as “adequate” in its 2005 Program Assessment and Rating Tool (PART) review, which was conducted under the program title “Drinking Water Research.”³⁹ In response to OMB recommendations following the 2005 PART, the program is currently 1) working to set targets for the remainder of its long-term and annual measures, and 2) improving its oversight of partners. To those ends, the program collected initial long-term measurement data resulting from its mid-cycle BOSC review in May 2007, and will collect formal long-term measurement data during its comprehensive BOSC review scheduled for fall 2009. These baseline data points will allow the program to set future targets.

Performance Targets:

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of Six Year Review decisions.	100	100	100	100	Percent

³⁹ For more information, see <http://www.whitehouse.gov/omb/expectmore/summary/10004371.2005.html>.

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of Contaminate Candidate List Decisions.	100	100	100	100	Percent

The research conducted under this program supports EPA Strategic Objective 2.3 – Enhance Science and Research. Specifically, the program conducts leading-edge, sound scientific research to support the protection of human health through the reduction of human exposure to contaminants in drinking water.

The program gauges its annual and long-term success by assessing its progress on several key measures. In 2009, the program will strive to complete 100% of its planned outputs in support of its long-term goals. In achieving these targets, the program will contribute to EPA’s goal of protecting human health through the reduction of human exposure to contaminants in drinking water.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (-\$691.0 / -0.3 FTE) This change reflects the net of restoring of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs.
- (-\$300.0 / -3.6 FTE) This reflects completion of a portion of arsenic methods research under the 2001 Arsenic Rule.
- (-\$560.0) This decrease is the net effect of increases for payroll and cost of living for all FTE, combined with a reduction based on the recalculation of base workforce costs.
- (-\$941.0 / -13.1 FTE) Resources are being redirected to support research for the development of provisional advisory levels within Homeland Security, work to support contaminated sites and asbestos in the Land Protection and Restoration program, and the advancement of water quality criteria for recreational waters and emerging water contaminants in the Water Quality program. Within drinking water, health effects research on disinfection byproduct mixtures is approaching completion and publication.
- (-\$1,000.0) This reflects a Congressionally directed increase included in the FY 2008 Omnibus appropriation for carbon sequestration research. Research on the human health effects and environmental impacts of carbon storage and sequestration will continue through STAR grants in FY 2009.

Statutory Authority:

SDWA; CWA; ERDDA; MPRSA.

Research: Water Quality Program/Project by Research Area

(Dollars in Millions)

	FY 2004 Enacted		FY 2005 Enacted		FY 2006 Enacted		FY 2007 Enacted		FY 2008 President's Budget		FY 2008 Enacted ²		FY 2009 President's Budget		FY 2009 vs. FY 2008 Enacted	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
ORD Long-Term Goal																
Criteria to support designated uses	\$22.2	121.1	\$22.9	118.8	\$22.7	114.5	\$22.6	112.9	\$22.2	110.2						
Assessment of aquatic systems impairment	\$9.7	47.0	\$9.9	51.3	\$12.7	60.0	\$12.8	59.3	\$12.9	59.3						
Protection and restoration of aquatic systems	\$10.7	50.2	\$9.9	49.5	\$13.5	62.3	\$19.8	62.7	\$20.0	62.8						
Biosolids	\$2.5	11.0	\$2.3	10.6	\$2.4	10.5	\$1.8	10.5	\$1.4	7.1						
Criteria development ¹											\$20.1	101.9	\$19.8	99.0	(\$0.3)	(2.9)
Watershed management: assessment, measures, and incentives ¹											\$29.6	111.4	\$30.4	111.6	\$0.8	0.2
Source control and management research: urban uses ¹											\$5.8	26.1	\$5.9	26.2	\$0.1	0.1
Total	\$45.1	229.3	\$45.0	230.2	\$51.3	247.3	\$57.0	245.4	\$56.5	239.4	\$55.6	239.4	\$56.2	236.8	\$0.6	(2.6)

Note: Includes estimates of workforce support costs

¹ In FY 2009, ORD revised its Long Term Goal structure within the Water Quality program. This was made retroactive to the FY 2008 Enacted.

² Reflects estimate of the FY 2008 Enacted.

Research: Water Quality
 Program Area: Research: Clean Water
 Goal: Clean and Safe Water
 Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
<i>Science & Technology</i>	<i>\$54,428.5</i>	<i>\$56,454.0</i>	<i>\$55,573.0</i>	<i>\$56,179.0</i>	<i>\$606.0</i>
Total Budget Authority / Obligations	\$54,428.5	\$56,454.0	\$55,573.0	\$56,179.0	\$606.0
Total Workyears	249.4	239.4	239.4	236.8	-2.6

Program Project Description:

The Water Quality research program is designed to support the Clean Water Act (CWA), providing scientific information and tools to the Agency and others to help protect and restore the designated uses of water bodies that sustain human health and aquatic life. The program conducts research on the development and application of water quality criteria; the implementation of effective watershed management approaches; and the application of technological options to restore and protect water bodies using information on effective treatment and management alternatives.

The Water Quality research program is responsive to the needs of EPA’s Water program and Regional Offices, which are the program’s primary clients in developing research priorities. The Agency maintains a Water Quality Research Program Multi-Year Plan⁴⁰ (MYP) that outlines steps and provides a timeline for meeting these needs along with related annual performance goals and measures for evaluating progress. EPA’s Board of Scientific Counselors (BOSC), a Federal advisory committee comprised of qualified, independent scientists and engineers, reviewed the Water Quality research program in January 2006. The BOSC review found “the Water Quality research program appropriately addresses EPA’s Strategic Goal 2 of Clean Water by creating the tools necessary for the Office of Water (OW) to establish water quality criteria and respond when those criteria are not being met, this includes using research results to comply with regulations and advance fundamental understanding. The program is responsive to EPA’s Office of Water, which the program has correctly identified as its primary client, in developing their research priorities.”⁴¹

FY 2009 Activities and Performance Plan:

⁴⁰ U.S. EPA, Office of Research and Development, *Water Quality Research Program Multi-Year Plan*. Washington, D.C.: EPA. Available at: <http://www.epa.gov/osp/myp.htm>.

² U.S. EPA, Board of Scientific Counselors, *Review of the Office of Research and Development’s Water Quality Research Program at the U.S. Environmental Protection Agency* (Washington: EPA, 2006). Available at: <http://www.epa.gov/osp/bosc/pdf/wq0605rpt.pdf>

Research efforts within the water quality research program are aligned with the Agency's strategic objectives⁴² under the CWA to:

- promulgate protective standards,
- identify contaminant contributions to impaired waters,
- use tools to restore and protect the nation's waters with due consideration to point and non-point sources of contamination, and
- maintain the nation's aging infrastructure.

In FY 2009, the Water Quality research program will support priorities set in consultation with EPA's Water program and Regional offices, taking into account such factors as pollutant/stressor type, water body types, and source of pollutants (e.g. agricultural versus urban). Research activities are categorized within three areas: 1) Water Quality Integrity Research; 2) Watershed Management Research; and, 3) Source Control and Management Research. Although the quality of the nation's waters has shown improvement, threats to water quality remain, and new threats continue to be identified.

Water Quality Integrity research priorities support regulatory driven needs related to revising aquatic life guidelines, recreational water criteria, and developing criteria for emerging contaminants (i.e. invasive species), nutrients, toxics, sediments, and multiple stressor effects on stream biota, including research on biological condition gradients for Tiered Aquatic Life Uses (TALU). Specific stressors include habitat alteration, nutrients, pathogens, and emerging contaminants. EPA's water program is the major client for research products developed under this research and will use them in the development and application of water quality criteria.

Research on diagnostic methods will enable EPA to continue its focus on the causes and sources of aquatic system impairment. Specifically, this research will provide the scientific foundation and information management scheme for an integrated process for assessing, listing, and reporting water quality conditions that meet or fail to meet statutory requirements, including a classification framework for surface waters, watersheds, and regions. As EPA directs and informs the efforts of the States to adopt nutrient criteria for individual water bodies, research is required to identify nutrient responses based on geographic region, water body type, and designated use. Research will continue toward linking stressor-response relationships to a biological condition gradient and TALU framework, while providing information on technical guidance for the development of nutrient water quality criteria for coastal wetlands and estuaries and Great Lakes.

The Water Quality program supports the adoption and implementation of watershed management approaches by States and Tribes as they require strong standards, monitoring, Total Maximum Daily Load (TMDL) determinations, and implementation programs, including best-management practices, restoration, and TMDL watershed plans. Watershed Management Research supports TMDL allocation processes with the development of information and integrated water quality and quantity modeling and monitoring tools. This research supports assessing condition, diagnosis of impairment, mitigation, and achieving success, including support for CWA Section

⁴² U.S. EPA, Office of the Chief Financial Officer, 2006-2011 EPA Strategic Plan, Washington, D.C.:EPA. Available at www.epa.gov/ocfo/plan/plan.html

305(b) reporting, use attainability analyses identifying designated uses, and TMDL adaptive management. Research efforts in this area include Gulf of Mexico Hypoxia research aimed at developing risk-based forecasting capability to aid water resource managers in making scientifically defensible nutrient management decisions to reduce the hypoxia problem, restore the natural habitats, and restore food web assemblages along the Gulf coast. Other research addresses identifying the locations and connectivity of headwater streams and wetlands (complimentary research on how and what role headwater streams and isolated wetlands play in reducing pollutant loads, and their effect on downstream quality is being conducted under the Ecological Research program to enhance our understanding of the benefits and value of ecological services); implementation support for suspended and bedded sediments frameworks; and technical assistance for watershed modeling and decision support tools. Key users of these products will be at the regional, state, and local level.

In addition, existing models of pollutant transport and fate will be expanded to allow the evaluation of alternative strategies for restoring and/or protecting local and state watersheds. Particular emphasis will be placed on strategies for nutrient control in rural/agrarian settings and on strategies for pollutant control in urban settings. Approaches will be studied for effectively monitoring the reduction in the water column pollutants and improvements in aquatic systems and for demonstrating the effectiveness of protecting designated uses from future development or other impacts.

The President's initiative to preserve and restore wetlands will be supported with research on how wetland processes assimilate nutrient contaminants. The water quality research that defines wetland performance is fundamental to the implementation of water quality trading programs. It will include a comparison of natural and constructed wetlands to determine how seasonal changes in hydrologic regime, stressor load, and upland land use affect the functioning of these systems and will inform the protection and restoration of wetlands. Economic assessments of the use of wetlands in water quality trading also will be conducted.

Research on the best management of manure is needed to ensure that environmentally responsible practices are available, and will continue in support of EPA's Wastewater Management program. Field studies of CAFOs will determine the magnitude of releases to ground waters and surface waters and evaluate control options with emphasis on nutrient and pathogen contaminants. This work will support the development of effective TMDLs and National Pollutant Discharge Elimination System (NPDES) permits.

Source control and management research priorities will develop information and tools to characterize, control, and manage point and non-point sources of water quality impairment. Research addresses aging infrastructure, green infrastructure, wet weather flows and residuals management. Major users of these products will be the Agency, states, regional authorities and municipalities.

Research will be conducted to assess and improve the control of microbial releases from POTWs during periods of significant wet weather events. During these events wastewater flow may exceed POTW treatment capacity, resulting in diversion of wastewater around secondary treatment units followed by recombination (i.e., "blending") with flows from the secondary

treatment units or discharging it directly into waterways from the treatment plant. ORD will evaluate findings of studies of the fate of pathogen indicators in three POTWs and conduct in-house research to understand the fate of pathogens and pathogen indicators and the effectiveness of destroying pathogens in blended effluents. This will help determine the extent of human health and environmental effects caused by wet weather events. Current POTW practices for handling significant wet weather events, such as blending, will be assessed to identify best practices during such events. In out years, this work will lead to reports that POTW managers can use to more cost-effectively operate their systems in wet weather conditions while still protecting water quality.

Research on the performance of non-point source best management practices (BMPs) will be conducted in order to provide information to watershed managers and others for the more cost-effective reduction of pollutant loading to surface waters. Particular emphasis will be placed on green infrastructure and on the variation of BMP cost and performance with geographical and other major influencing variables.

In FY 2009, research will continue the development of innovative solutions to manage the nation's aging wastewater infrastructure. Research started in FY 2007 under the "Water Infrastructure for the 21st Century" initiative will continue to develop the science and engineering to improve and evaluate promising innovative technologies and techniques to increase the effectiveness and reduce the cost of operation, maintenance, and replacement of aging and failing wastewater conveyance systems. Research efforts will demonstrate technologies and approaches for new and innovative condition assessment, rehabilitation, and design of wastewater collection systems and comprehensive asset management. This research will support EPA in developing policy and revolving funds allocation decisions to address this multi-billion dollar problem faced by the Nation, and will support utilities and other stakeholders involved in meeting community watershed management goals and in the cost-effective assessment, rehabilitation and management of their systems.

EPA will continue to support the Pathogens Equivalency Committee. This effort evaluates innovative approaches to sewage sludge treatment for the purposes of determining whether they meet requirement of Part 503 (biosolids) regulations.

The Office of Management and Budget (OMB) rated the program as "adequate" in its 2006 (PART) review, which was conducted under the program title "Water Quality Research."⁴³ This "adequate" rating was supported by findings that the program had long-term and annual output performance measures in place that reflected the purpose of the program, as well as a preliminary output efficiency measure. In response to OMB recommendations following the 2006 PART, the program has established a process by which the BOSC will assign a progress rating to each program long-term goal as part of its reviews. These ratings will provide the data for new program long-term outcome measures that will be instated. Using these baseline ratings, the program will be able to set appropriate future year targets. Additionally, to address OMB's recommendation that the program establish an outcome-oriented efficiency measure, EPA has initiated a National Academy of Sciences (NAS) study to determine the most appropriate approach.

⁴³ For more information, see <http://www.whitehouse.gov/omb/expectmore/summary/10004306.2006.html>

Performance Targets:

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Efficiency	Peer-reviewed publications over FTE.				.82	Publications

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs (in support of WQRP long-term goal #1) delivered	100	100	100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs (in support of WQRP long-term goal #2) delivered	100	100	100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs (in support of WQRP long-term goal #3) delivered	100	100	100	100	Percent

The research conducted under this program supports EPA Strategic Objective 2.3- Enhance Science and Research. Specifically, the program conducts leading-edge, sound scientific research to support the protection of human health through the reduction of human exposure to contaminants in fish and shellfish, and recreational waters, and to support the protection of aquatic ecosystems.

In 2009, the program plans to accomplish its goals of completing and delivering 100% of its planned outputs. In achieving these targets, the program will contribute to EPA’s goal of supporting the protection of human health through the reduction of human exposure to contaminants in fish, shellfish, and recreational waters, and to support the protection of aquatic resources. Additionally, the program strives to improve its number of publications per FTE to .82. In achieving these targets, the program will better enable EPA to meet its goals.

FY 2009 Change from FY 2008 Enacted (Dollars in Thousands):

- (+\$1,042.0) This change reflects restoration of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs.

- (-\$436.0) This decrease is the net effect of increases for payroll and cost of living for existing FTE, combined with a reduction based on the recalculation of base workforce costs.
- (-2.6 FTE) This decrease reflects EPA's workforce management strategy that will help the Agency better align resources, skills and Agency priorities.

Statutory Authority:

CWA; ODBA; SPA; CVA; WRDA; WWWQA; MPPRCA; NISA; CZARA; CWPPRA; ESA; NAWCA; FIFRA; TSCA; ERDDA.

**EPA ORD Research Budget Sections For 2009 –
Human (and Ecological) Health**

- a) **Human Health**
- b) **Human Health Risk Assessment**
- c) **Computational Toxicology**
- d) **Endocrine Disruptors**
- e) **Safe Pesticides/Safe Products**

Research: Human Health and Ecosystems Program/Project by Research Area
(Dollars in Millions)

ORD Multi-Year Plan ORD Long-Term Goal	FY 2004 Enacted		FY 2005 Enacted		FY 2006 Enacted		FY 2007 Enacted		FY 2008 President's Budget		FY 2008 Enacted ²		FY 2009 President's Budget		FY 2009 vs. FY 2008 Enacted	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
Ecosystems	\$108.0	333.1	\$86.5	325.5	\$86.3	299.1	\$79.3	295.6	\$68.2	288.6	\$71.3	288.6	\$66.0	265.8	(\$5.3)	(22.8)
Assess ecosystem condition	\$49.4	116.2	\$38.6	108.5	\$34.2	99.2	\$31.3	97.8	\$22.4	99.3	\$23.2	99.3				
Protect and restore aquatic ecosystems	\$7.5	33.3	\$7.8	35.6	\$10.7	34.1	\$8.2	33.9	\$7.4	33.9	\$7.6	33.9				
Ecosystem diagnosis	\$23.8	85.0	\$17.6	81.4	\$17.9	75.6	\$17.5	75.6	\$17.3	75.6	\$17.9	75.6				
Ecosystem Forecasting	\$27.3	98.7	\$22.5	100.0	\$23.5	90.2	\$22.3	88.2	\$21.1	79.8	\$22.5	79.8				
Decision Support Platform ¹													\$10.9	42.4	\$10.9	42.4
Mapping Monitoring, and Modeling ¹													\$39.6	164.3	\$39.6	164.3
Nitrogen Assessment ¹													\$1.0	3.6	\$1.0	3.6
Ecosystem Type Assessment ¹													\$3.7	15.0	\$3.7	15.0
Place Based Projects ¹													\$10.8	40.4	\$10.8	40.4
Human Health	\$50.4	142.0	\$60.2	171.9	\$61.6	193.0	\$60.8	187.9	\$56.8	185.5	\$62.4	185.7	\$56.6	195.0	(\$5.8)	9.3
Mechanistic Data to reduce uncertainty	\$7.8	38.3	\$9.9	40.3	\$11.0	51.1	\$10.5	49.1	\$10.9	49.2						
Aggregate and Cumulative Risk	\$9.5	29.6	\$17.5	50.4	\$17.3	49.5	\$16.9	47.5	\$15.4	41.2						
Susceptible Subpopulations	\$31.5	70.5	\$30.0	77.6	\$31.3	88.9	\$32.0	87.8	\$28.9	91.7	\$28.4	71.7	\$24.1	72.5	(\$4.3)	0.8
Evaluating public health outcomes	\$1.7	3.7	\$2.8	3.6	\$2.0	3.5	\$1.5	3.5	\$1.6	3.5						
Use of Mechanistic Information ¹											\$8.6	46.6	\$8.9	48.9	\$0.3	2.3
Cumulative Risk ¹											\$20.9	57.3	\$19.5	62.9	(\$1.4)	5.6
Assess risk management decisions ¹											\$4.5	10.2	\$4.1	10.7	(\$0.4)	0.5
Mercury	\$7.0	7.7	\$5.2	7.2	\$3.7	12.7	\$3.9	13.1	\$4.3	13.1	\$4.0	13.1	\$4.4	10.8	\$0.4	(2.3)
Assess and manage mercury risks	\$0.4	2.0														
Mercury source characterization and treatment	\$3.5	5.2	\$3.7	5.2	\$3.4	10.9	\$3.4	10.3	\$3.8	10.3	\$3.1	11.4	\$3.3	8.9	\$0.2	(2.5)
Transport and fate of mercury and its effects on receptors	\$3.1	0.5	\$1.5	2.0	\$0.3	1.8	\$0.4	2.8	\$0.5	2.8	\$0.9	1.7	\$1.1	1.9	\$0.2	0.2
Emerging Risk Issues and Risk Policy Assessment Forum	\$15.7	25.2	\$15.5	15.7	\$11.3	5.0	\$12.2	12.7	\$10.7	9.8	\$10.2	9.6	\$12.7	6.7	\$2.5	(2.9)
Advanced Monitoring Initiative	\$0.0	0.0	\$0.0	0.0	\$4.9	0.0	\$5.1	0.0	\$5.1	0.0	\$4.9	0.0	\$5.1	0.0	\$0.2	0.0
Total	\$181.2	508.0	\$167.4	520.3	\$167.7	509.8	\$161.2	509.3	\$145.0	497.0	\$153.0	497.0	\$144.7	478.3	(\$8.3)	(18.7)

Note: Includes estimates of workforce support costs

¹ In FY 2009, ORD revised its Long Term Goal structure within the Ecosystems and Human Health programs. For Human Health, this was made retroactive to the FY 2008 Enacted.

² Reflects estimate of the FY 2008 Enacted.

Research: Human Health and Ecosystems

Program Area: Research: Human Health and Ecosystems

Goal: Healthy Communities and Ecosystems

Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
<i>Science & Technology</i>	<i>\$167,910.0</i>	<i>\$145,046.0</i>	<i>\$153,032.0</i>	<i>\$144,742.0</i>	<i>(\$8,290.0)</i>
Total Budget Authority / Obligations	\$167,910.0	\$145,046.0	\$153,032.0	\$144,742.0	(\$8,290.0)
Total Workyears	520.3	497.0	497.0	478.3	-18.7

Program Project Description:

The Agency conducts human health and ecosystems research to: 1) identify and characterize environment-related human health problems and determine exposures to and sources of agents responsible for these health concerns; and 2) identify the impacts of human activities on ecosystem services, measure the relationship between human well-being and ecosystem services, and provide tools for policy makers and managers to protect and restore ecosystem services through informed decision making at multiple spatial and temporal scales. The Human Health and Ecological Research Program also supports mercury research, advanced monitoring research, nanotechnology research, exploratory research, and the Agency's Report on the Environment (ROE).

Both the human health and ecosystems research programs are continually evolving. The Human Health research program is working to maintain its success in "reducing uncertainties in risk assessment" while orienting the program toward "developing and linking indicators of risk" along the source-exposure-effects-disease continuum that can be used to demonstrate reductions in human risk. This strategic shift is designed to include research that addresses limitations, gaps, and challenges articulated in the 2003 and 2007 Reports on the Environment. The Ecological research program is transitioning from a focus on monitoring ecosystem conditions to a focus on understanding and protecting ecosystem services, which represents a natural progression that builds upon existing work that seeks to inform decision-making processes.

Research is guided by the "Human Health Research Strategy"⁶³ and the "Ecological Research Strategy,"⁶⁴ which were developed in collaboration with major clients (e.g., EPA's Program and Regional Offices). These strategies outline the program's research needs and priorities. Under this program, several multi-year plans (MYPs)⁶⁵ (e.g., human health, ecological research, and mercury) convey research priorities and approaches for achieving goals and objectives. MYPs

⁶³ U.S. EPA, Office of Research and Development. *Human Health Research Strategy*. Washington, DC: EPA. Available at: http://www.epa.gov/nheerl/humanhealth/HHRS_final_web.pdf.

⁶⁴ For more information, see <http://www.epa.gov/ord/htm/documents/eco.pdf>.

⁶⁵ For more information, see <http://www.epa.gov/osp/myip>.

outline the steps for meeting client research needs, as well as annual performance goals and key research outputs for evaluating progress.

The Human Health research program and the Ecological research program both underwent successful reviews by EPA's research advisory committee, the Board of Scientific Counselors (BOSC) in March of 2005. The BOSC stated, "The research of the human health research program is of high quality and appropriately focused, it is multidisciplinary, yet coherent and coordinated, and the research benefits from managerial excellence across all aspects of the program."⁶⁶ The BOSC also commented that these planned actions and initiatives provide "great potential for significant impacts in the future." In 2007, mid-cycle reviews of each program resulted in a rating of "Meets Expectations" for work completed to date.⁶⁷

The BOSC review of the Ecological research program found that the program's "strategy still recognizes the importance of continuing ORD's support to ensure that appropriate environmental and ecological data are collected in monitoring programs, especially use of sampling and analysis approaches that can be corroborated by ORD research" and that "the evolving emphasis on ecosystems services and value is appropriately laid out and justified."⁶⁸

FY 2009 Activities and Performance Plan:

Human Health Research

In FY 2009, EPA is proposing a program designed to identify indicators of risk (effects, susceptibility, and exposure indicators) that can be used to demonstrate reductions in human health risks (i.e., evaluate effectiveness of risk management or regulatory decisions). Of the total \$75 million requested in FY 2009 for Human Health research, \$57 million is requested for research in this area. This research will focus on the development of sensitive and predictive methods to identify viable bioindicators of exposure, susceptibility, and effect that could be used to evaluate public health impacts at various geospatial and temporal scales. Research also will focus on developing biologically based models to predict biological effects based on internal dose.

EPA will continue to support research on mode of action information that can be used to reduce reliance on default assumptions in chemical risk assessments, particularly as related to selection of appropriate dose-response models for risk assessment and protection of vulnerable populations. Such research will inform the re-evaluation of acceptable levels of arsenic and its metabolites in drinking water, as well as the risk assessments of cancer and non-cancer effects of conazoles and structurally related fungicides. Additional research efforts will develop emerging molecular methods and systems biological approaches to identify critical toxicity pathways, e.g.,

⁶⁶ *Report of the Subcommittee on Health*, revised July 27, 2005, Board of Scientific Counselors, pg 9. For more information, see <http://www.epa.gov/osp/bosc/pdf/hh0507rpt.pdf>.

⁶⁷ U.S. EPA, Board of Scientific Counselors. *Mid-Cycle Review of the Office of Research and Development's Human Health Research at the U.S. Environmental Protection Agency*. (Washington: EPA, 2007). Available at: <http://epa.gov/osp/bosc/pdf/hhmc072307rpt.pdf>.

⁶⁸ U.S. EPA, Board of Scientific Counselors, *Mid-Cycle Review of the Office of Research and Development's Ecological Research at the U.S. Environmental Protection Agency*. (Washington: EPA, 2007). Available at: <http://www.epa.gov/OSP/bosc/pdf/ecomc082307rpt.pdf>

oxidative stress, neuroendocrine disruption, for characterizing the effects of chemicals (such as particulate matter, metals, pesticides, and chemical contaminants in drinking water) on human health.

Research will develop tools for identifying communities (*e.g.*, localities, populations, groups) at greatest risk, identifying and quantifying the factors influencing these exposures, and developing and implementing appropriate risk reduction strategies. Research on intervention and prevention strategies will ultimately reduce human risk associated with exposures to single and multiple environmental stressors. Cumulative risk research will develop approaches for restructuring exposures from biomarker data generated in large-scale exposure and epidemiological studies and linking these exposures to their primary sources, and for using exposure, biomarker, and pharmacokinetic data in cumulative risk assessments. For example, in 2007, EPA's Human Health research program discovered a biomarker that can predict the severity of an asthmatic response in susceptible people, resulting in new protocols for improving indoor air quality and providing the scientific basis for public education policies and risk management strategies involving exposure to molds.

Other human health research will continue to focus on exposures to environmental contaminants and subsequent effects during critical life-stages, such as early development, childhood, or aging. Efforts related to children's health include identification of the key factors influencing children's exposures to environmental toxicants (including chemical exposure in schools) and the production of high quality children's exposure data to reduce current uncertainties in risk assessment. Human health research focused on physiological and biochemical changes during critical life-stages will be used as a basis for understanding susceptibility and the role of environmental stressors in the exacerbation or pathogenesis of disease.

EPA also will continue to support and collaborate with the EPA-sponsored Centers for Children's Environmental Health and Disease Prevention Research (FY 2009 Request, \$6 million), which study whether and how environmental factors play a role in children's health. This continued interaction is supported by the BOSC, which encourages synergistic research progress. These unique Children's Centers perform targeted research in children's environmental health and translate their scientific findings into intervention and prevention strategies by working with communities. The Children's Centers have established long-term birth and school age cohorts that follow participants over many years to consider the full range of health effects resulting from exposure to environmental chemicals. Additionally, the Children's Centers are tracking a wide range of environmental exposures at multiple stages of development to evaluate relationships between these exposures and observed health effects.

In FY 2009, research on public health outcomes will continue to assess the cumulative impact of a suite of air pollution reduction programs on environmental public health indicators for children and older populations. Research to determine the effectiveness of regulatory decisions on human health following exposure to waterborne pathogens will continue. EPA also will move toward integrating valid and predictive bioindicators of exposure, susceptibility and effects to develop approaches to assess public health impacts of regulatory decisions, including developing environmental health outcome indicators through the Agency's Science to Achieve Results (STAR) program.

The Office of Management and Budget (OMB) rated the program as “adequate” in a 2005 Program Assessment Rating Tool (PART) review, which was conducted under the program title “Human Health Research.”⁶⁹ This rating was attributed to findings that the program had a focused design, meaningful performance measures, and that the program’s research results were being used to reduce uncertainty in risk assessment. In response to OMB recommendations after the 2005 PART, the program has implemented all follow-up recommendations resulting from its 2005 BOSC review; has established preliminary targets for its long-term measures based on BOSC mid-cycle review feedback; and has worked to improve its budget and performance integration.

Ecological Research

In FY 2009, the total level of funding requested for Ecosystems research is \$70 million. The Ecological Research Program (ERP) is a multi-media program consistent with the integrated perspectives of the Agency’s Healthy Communities and Ecosystems goal (FY 2009 Request, \$66 million). The program’s ultimate goal is that decision-makers routinely apply information and methods developed by this program to make proactive policy and management decisions that ensure human well-being by conserving and enhancing ecosystem services over time and at multiple scales. Four areas will comprise the research program: (1) defining ecosystem services and their implications for human well-being and valuation; (2) measuring, monitoring, and mapping ecosystem services at multiple scales over time; (3) developing predictive models for quantifying and forecasting the changes in ecosystem services under alternative management scenarios; and (4) developing and adapting a decision support platform for decision makers to use to protect and restore ecosystem services through informed decision making at multiple spatial and temporal scales. These research areas will be carried out through three different types of studies: (a) the study of the impact of a nationally important pollutant (reactive nitrogen—for example, in support of the new NO_x/SO_x NAAQS) on ecosystem services; (b) the study of ecosystem services in important ecosystems (wetlands and coral reefs) for which the Agency has responsibilities; and (c) the study of real places facing the trade-off among ecosystems while conserving services provided.

In FY 2009, the emphasis on the Environmental Monitoring and Assessment Program (EMAP) will continue to decrease as the methods for national aquatic surveys are transferred to states and tribes with EPA oversight. Continuing technical support for implementing the surveys will transfer to the Water Quality Research program in Goal 2. These transfers are natural progressions, from core research to applications in other program research and use by the Program Offices. However, a continuing challenge is upgrading of EMAP to using real-time, sensor based technology for the most critical chemical and biological measurements.

The EMAP design significantly reduces the cost of monitoring for large scale studies by taking a random sample of sites at a carefully chosen point in time. The ecological research program will begin examining monitoring design and implementation options focused on field sensors that would be used to decrease the need for field visits through the placement of field proven remote sensors. By doing so, not only will the cost of field sampling be reduced, but the frequency of measurements for selected sites can be greatly increased at no additional cost. These more

⁶⁹ For more information, see <http://www.whitehouse.gov/omb/expectmore/summary/10004373.2005.html>.

frequent measures would be helpful in better understanding the response of ecosystems to seasonal and annual changes, particularly to improve model predictions of change. The combination of the more efficient EMAP site selection process and the remotely sensed real-time data would make EMAP a more cost effective ecological monitoring system.

The new emphasis of the ERP will be to advance a more comprehensive theory and practice for quantifying ecosystems services, their values, and their relationships to human well being. The goal is consistent incorporation into environmental decision making at local, regional and national scales.

Over the next few years, this focus will become the primary direction of the ecological research program. Ecosystem services, e.g., the ability of vegetation to retain water and nutrients, to provide habitat for animals, to decrease run-off to streams, rivers and lakes, to sequester carbon, and to provide food and shelter are often considered free and infinite. However, misuse of these services leads to degradation or destruction and they are costly to replace when gone. A well-known current example is the decrease in honey bee populations and thus their free service provided to farmers nationally for pollination of crops have to be replaced by some means- at additional costs ultimately passed on to the consumer. The same can be said for the high costs of replacing the natural water retention provided by healthy ecosystems that has to be replaced by costly storm sewers that are currently overloaded in many communities. Another example is the elimination of wetlands that protect coastal areas from storm surge.

The ERP research is supporting the *EPA Ecological Benefits Assessment Strategic Plan* and Executive Order 12866 which deal with assessing costs and benefits of alternative strategies for environmental protection. The research is expected to be the first integrated program to address the difficult topic of maintaining, enhancing, and restoring the services provided by the natural environment. As a result, the ERP will provide the scientific basis for including more comprehensive valuations of ecosystem services than currently possible into management strategies by clarifying the economic, social and ecological ramifications of various management options. The work is broadly applicable across the Agency as the regulatory programs prepare cost and benefit analyses of their decisions on alternative regulatory strategies. Because the program must incorporate social and economic sciences, opportunities to collaborate with non-traditional partners within and outside of EPA will facilitate a unique, more cross-disciplinary, more broadly applicable research program. In collaboration with Agency partners within the Water program, the Air and Radiation program, the Policy, Economics, and Innovation program, and EPA Regions and offices, the Ecological Research program has identified four immediate uses for information on ecosystem services:

- Provide technical support for agency policies, including voluntary measures such as environmental stewardship;
- Provide improved techniques for estimating the benefits and costs related to national rule-making;
- Develop metrics on ecosystem services (e.g., for use in the Report on the Environment or for creating environmental Gross Domestic Product accounts); and
- Create credible scientific foundations for market incentives (e.g., for ecosystem services trading or for investments in conservation).

Every day, local town, county, and state managers make decisions to support economic growth. The information provided by the program will enable the manager/community to better decide where, for example, development should best occur to maintain or improve storm water flow, increase recreational opportunities by the location of functional wetlands, protect local water resources, and at the same time, decrease the cost to the community for these services they will want or require. The desired outcome of the research is for decision makers to be able to better understand the ways in which their choices affect the type, quality and magnitude of the services we receive from ecosystems such as clean air and water, productive soils and food, when local, regional, or national decisions need to be made.

Diagnostics and forecasting research in the current program will be shifting to development and understanding of models describing (quantifying changes) and forecasting the response of ecosystem services to human actions and natural stressors at multiple scales over time. It is the decision support tools for policy makers and managers that will ultimately facilitate the protection and restoration of ecosystems. These tools (e.g., models, maps, animations, and other data rich displays) will be created for explicit and proactive examination of a range of management options at multiple spatial and temporal scales. Environmental managers will use these tools to identify and prioritize the most effective approaches and methods for conserving, enhancing or restoring important ecosystem services, so that their actions are as cost-effective as can be achieved. Field-based research will be conducted on approaches and methods to conserve, enhance or restore important ecosystem services, in particular, water and nutrient regulation, soil retention, biomass production, and water supplies in riparian zones and wetlands.

The Program will provide guidance and tools for balancing the protection and use of ecological resources. Tools and models will, therefore, be created in a context relevant to economic, socio-cultural, and human health needs. The collection of activities and products will transform the way we understand and respond to environmental change by shaping future policy and management decisions, based on a much improved understanding of the ecosystem services we often take for granted.

The Ecological Research program received a “moderately effective” rating in its most recent OMB PART review in 2007. While the program received a “results not demonstrated” rating in 2003, and an “ineffective” rating in 2005, the program has made extensive progress and continues to improve by: 1) developing and publishing a revised multi-year research plan that clearly demonstrates how the program’s research supports the EPA mission, avoids duplication with other research programs, and ensures the strategic vision of the program is current and outcome-oriented; 2) increasing budget, program and performance information transparency in budget documents; and 3) educating the Agency on program utility and performance in relationship to environmental outcomes to enhance independent science reviews.

Exploratory Grants and Nanotechnology Research

EPA is increasingly focused on nanotechnology’s implications for environmental health and safety. The Agency’s efforts are coordinated with other Federal agencies through the National Nanotechnology Initiative (NNI)⁷⁰. EPA’s nanotechnology research (FY 2009 Request, \$14.9

⁷⁰ For more information, see <http://www.nano.gov/>.

million, including \$2.7 million in the Land research program, \$11.8 million in the Human Health and Ecosystem research program, and \$0.2 million in both the Air and Sustainability research programs) also is guided by a nanotechnology white paper⁷¹ prepared by the Agency and an environmental, health, and safety research needs document⁷² prepared by the Nanotechnology Environmental and Health Implications Working Group of the National Science and Technology Council's Subcommittee on Nanoscale Science, Engineering and Technology.

In FY 2009, the Agency's Science to Achieve Results (STAR) program will continue to fund exploratory grants on the implications of manufactured nanomaterials on the environment and human health, in collaboration with other Federal agencies.⁷³ The Agency also will continue in-house nanotechnology research initiated in FY 2007. The integrated programs will focus on assessing the potential ecological and human health exposures and effects from nanomaterials likely to be released into the environment; studying the lifecycles of nanomaterials to better understand how environmental releases may occur; developing methods to detect releases of nanomaterials; and using nanotechnology to detect, control, remediate, or prevent traditional pollutants. Nanotechnology research also is supported in the Research: Land Protection and Restoration program and, to a lesser extent, other programs.

Report on the Environment and Advanced Monitoring Initiative

The Report on the Environment (ROE) plays a critical role in EPA's strategic planning activities as the Agency develops and implements more transparent and outcome-oriented measures and indicators. In FY 2009, EPA will continue mission-based research that will help support this triennial report.

FY 2009 research in the Advanced Monitoring Initiative (AMI) will link various EPA offices/regions and other research programs to improve Agency decision-making and analyze program performance of FY 2006-2008 AMI investments (FY 2009 Request, \$5 million). The initiative also will continue to connect information technology advancements with advances in remote sensing and *in-situ* monitoring to improve the interface between research products and environmental and health decision-making. EPA and its partners will continue to integrate socioeconomic, human health, and ecosystem databases and models, to monitor the health of humans and the environment over greater expanses, in less time, and more cost-effectively than ever before, supporting decision-making processes that provide clear societal benefits in the near term. In addition to improving collaborative capabilities focused on decision-making, EPA will continue building a knowledge base of the accumulated AMI learning experience. This effort is linked with the interagency U.S. Global Earth Observations (USGEO) initiative and with the international community through the Global Earth Observation System of Systems (GEOSS) 10-Year Implementation Plan. Each year since 2003, the annual OMB/Office of Science and

⁷¹ Environmental Protection Agency, *Nanotechnology White Paper* (Washington: EPA, 2006). Available at: <http://www.epa.gov/osa/nanotech.htm>.

⁷² National Science and Technology Council, *Environmental, Health, and Safety Research Needs for Engineered Nanoscale Materials* (Washington: NSTC, 2006). Available at: http://www.nano.gov/NNI_EHS_research_needs.pdf

⁷³ For more information, see <http://es.epa.gov/ncer/nano/>.

Technology Policy (OSTP) Memorandum on Research and Development Budget Priorities⁷⁴ has encouraged agency efforts to align with USGEO and GEOSS.

Mercury Research

EPA has developed a multi-year plan for studying mercury (FY 2009 Request, \$4 million), including its sources, control and treatment, environmental fate and behavior, impacts on ecological resources, and potential effects on human health.⁷⁵ In FY 2009, the program will continue to support the Agency's recent Clean Air Mercury Rule (CAMR),⁷⁶ including research to determine whether mercury "hot spots" exist. EPA also will study the aquatic fate and transport of mercury in order to better understand the relationship between emissions and mercury concentrations in fish tissue, an important pathway to human exposure.

In collaboration with the Department of Energy and others, research will focus on emissions monitors to determine the amount and characteristics of mercury emitted by sources such as coal-fired utilities. The program also will develop and evaluate emissions control technologies, with an emphasis on technologies that can simultaneously control mercury and other air pollutants, and investigate whether mercury removed from coal-fired power plant emissions remains stably trapped in combustion and scrubber residues.

Performance Targets:

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Efficiency	Average time (in days) to process research grant proposals from RFA closure to submittal to EPA's GAD, while maintaining a credible and efficient competitive merit review system	254	307	292	277	Average Days

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of State, tribe, and relevant EPA office needs for environmental	100	100	100	100	Percent

⁷⁴ OMB/OSTP FY 2008 Administration Research and Development Budget Priorities Memorandum for the Heads of Executive Departments and Agencies, June 2006.

⁷⁵ EPA, Office of Research and Development, *Mercury Research Multi-Year Plan* (Washington: EPA, 2003). See <http://www.epa.gov/osp/myp/mercury.pdf>.

⁷⁶ For more information, see <http://www.epa.gov/air/mercuryrule/>.

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
	forecasting tools and methods to forecast the ecological impacts of various actions.					

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of Ecological Research publications rated as highly-cited publications.	21.10	20.4	No Target Established	21.4	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of Ecological research publications in "high-impact" journals.	20.80	20.3	No Target Established	21.3	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of State, tribe, and EPA office needs for environmental restoration and services tools and methods to protect and restore ecological condition and services.	100	100	100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of State, tribe, and relevant EPA office needs for causal diagnosis tools and methods to determine causes of ecological degradation.	67	100	100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of public health outcomes long-term goal.	100	100	100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Outcome	Percentage of peer-reviewed EPA risk assessments in which ORD's characterization of aggregate/cumulative risk is cited as supporting a decision to move away from or to apply default risk assessment assumptions.	This is a long-term measure, no data was collect in FY 2007	This is a long-term measure, no targets for FY 2007	This is a long-term measure, no targets for FY 2008	5.5	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of mechanistic data long-term goal.	100	100	100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Outcome	Percentage of peer-reviewed EPA risk assessments in which ORD's mechanistic information is cited as supporting a decision to move away from or to apply default risk assessment assumptions.	This is a long-term measure, no data was collect in FY 2007	This is a long-term measure, no targets for FY 2007	This is a long-term measure, no targets for FY 2008	16.5	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Outcome	Percentage of peer-reviewed EPA RAs where ORD methods,	This is a long-term measure,	This is a long-term measure,	This is a long-term measure,	3.5	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
	models or data for assessing risk to susceptible subpopulations is cited as supporting a decision to move away from or apply default risk assessment assumptions	no data was collect in FY 2007	no targets for FY 2007	no targets for FY 2008		

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of aggregate and cumulative risk long-term goal.	100	100	100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of the susceptible subpopulations long-term goal.	100	100	100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Efficiency	Percent variance from planned cost and schedule.	Data Lag	-11.6	-9.6	-7.6	Percent

The research conducted under this program supports EPA Strategic Objective 4.4. Specifically, the program identifies and synthesizes the best available scientific information, models, methods, and analyses to support Agency guidance and policy decisions with a focus on human, community, and ecosystem health.

The programs gauge their annual and long-term success by assessing progress on several key measures. In 2009, the Human Health research program plans to accomplish its goals of completing and delivering 100% of its planned outputs. The program is also targeting increases in the percentage of its peer reviewed risk assessments in which ORD's research is cited as supporting a decision to move away from or to apply default risk assessment assumptions, as was encouraged in the 2005 BOSC review. Additionally, the program plans to meet its efficiency goal of reducing the average time for processing research grants to 277 days.

As evidence of the utility of its research, the Ecological research program strives, by 2009, to have forty states use a common monitoring design and appropriate indicators to determine the status and trends of ecological resources and the effectiveness of programs and policies. The program also aims to make further improvements in its bibliometric analysis results, and is targeting a “highly cited” publication rate of 21.4%, and a “high impact” publication rate of 21.3%. Improvements in the percentage of program publications deemed “highly cited” and “high impact” demonstrates increased quality and utility of the program’s research. The program also plans to meet 100% of its planned outputs in support of each long-term goal while increasing efficiency. As a measure of efficiency, the program plans to continue working to decrease its percent variance from planned cost and schedule, a measure that the National Academy of Sciences is currently reviewing as part of a study to determine the best approach for measuring the efficiency of research. In achieving these targets, the programs will enable EPA to meet its goal of providing scientifically sound guidance and policy decisions related to human health and ecosystems.

FY 2009 Change from FY 2008 Enacted (Dollars in Thousands):

- (+\$3,600.0 / +4.0 FTE) This reflects an increase in resources to advance the timetable to achieve goals identified in the EPA Nanomaterial Research Strategy: supporting health and ecological implications arising from new routes of exposure and/or toxicities associated with exposure to these novel materials; identifying and developing risk assessment methodologies for use by agency risk assessors; and evaluating the adequacy of current exposure assessment approaches. The change in workyears reflects EPA’s workforce management strategy that will help the Agency better align resources, skills and Agency priorities. It is an internal redirection of workyears from human health research to support the nanotechnology research effort.
- (+\$1,000.0) This increase will support research to advance environmental monitoring and assessment. This work will take advantage of the Small Business Innovation Research (SBIR) program to develop sensor-based technologies for real-time monitoring of critical chemical and biological parameters.
- (+\$3,085.0 / -0.9 FTE) This change reflects restoration of the 1.56% rescission to all program projects in addition to technical changes such as realignment of IT, travel or other support costs across programs.
- (-\$6,000.0) This reduction is the result of a Congressionally directed increase included in the FY 2008 Omnibus for basic human health research, including STAR grants and exposure research.
- (-\$4,000.0) This reflects a Congressionally directed increase included in the FY 2008 Omnibus appropriation for the Environmental Monitoring and Assessment Program (EMAP). This increase funds monitoring efforts on U.S. aquatic resources.
- (-\$3,397.0) This reduces funding for lower-priority human health research, including planned observational studies for asthma exposure data, and STAR grants on susceptible

populations not related to the Children's Centers. All high priority human health research will continue.

- (-\$1,401.0 / -21.8 FTE) This reflects realignment of programmatic and support workyears between the human health and ecosystems, land protection and restoration, drinking water, and computational toxicology research programs and recalculation of their associated support costs to more closely align with programmatic priorities. The change in workyears reflects EPA's workforce management strategy that will help the Agency better align resources, skills and Agency priorities.
- (-\$1,153.0) This reduction discontinues the grant portion of the Greater Research Opportunities (GRO) program. Half of these resources for GRO grants will be redirected to support GRO fellowships in the Fellowships Program. The Agency will continue to manage GRO grants awarded prior to FY 2009. This realignment will allow the GRO program to better meet the Agency's goals.
- (-\$24.0) This decrease is the net effect of increases for payroll and cost of living for existing FTE, combined with a reduction based on the recalculation of base workforce costs.

Statutory Authority:

CAA; SDWA; ERDDA; CWA; FIFRA; FFDCA; RCRA; FQPA; TSCA; USGCRA.

Human Health Risk Assessment Program/Project by Research Area

(Dollars in Millions)

	FY 2004 Enacted		FY 2005 Enacted		FY 2006 Enacted		FY 2007 Enacted		FY 2008 President's Budget		FY 2008 Enacted ²		FY 2009 President's Budget		FY 2009 vs. FY 2008 Enacted	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
ORD Long-Term Goal																
Human Health Risk Assessment and IRIS	\$18.0	78.3	\$19.8	91.8	\$20.8	99.5	\$22.0	98.0	\$24.4	110.5	\$24.1	110.5	\$25.1	109.5	\$1.0	(1.0)
Risk Assessment Research, Methods, Guidance, and Risk Assessment Forum	\$14.0	59.1	\$12.2	57.0	\$14.1	59.3	\$12.4	61.2	\$11.5	46.3	\$11.3	46.3	\$10.5	44.0	(\$0.8)	(2.3)
Integrated Science Assessments ¹	\$4.0	22.3	\$4.2	23.5	\$4.5	25.2	\$4.6	24.7	\$6.9	25.3	\$6.8	25.3	\$7.1	25.0	\$0.3	(0.3)
Total	\$36.0	159.8	\$36.3	172.3	\$39.4	184.0	\$39.1	183.9	\$42.8	182.1	\$42.2	182.1	\$42.6	178.6	\$0.4	(3.5)

Note: Includes estimates of workforce support costs

¹ In FY 2008, ORD revised its process for supporting the setting of the NAAQS. The LTG was previously titled "Air Quality Criteria Documents."

² Reflects estimate of the FY 2008 Enacted.

Human Health Risk Assessment

Program Area: Research: Human Health and Ecosystems

Goal: Healthy Communities and Ecosystems

Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
<i>Science & Technology</i>	<i>\$35,018.0</i>	<i>\$38,856.0</i>	<i>\$38,334.0</i>	<i>\$39,323.0</i>	<i>\$989.0</i>
Hazardous Substance Superfund	\$3,926.4	\$3,972.0	\$3,910.0	\$3,325.0	(\$585.0)
Total Budget Authority / Obligations	\$38,944.4	\$42,828.0	\$42,244.0	\$42,648.0	\$404.0
Total Workyears	176.3	182.1	182.1	178.6	-3.5

Program Project Description:

Human health risk assessment is a process where information is analyzed to determine if an environmental hazard might cause harm to exposed persons (National Research Council, 1983). Health assessments generated by EPA's Research and Development program are used extensively by EPA Program and Regional offices, and other parties to determine the potential risk to public health from exposure to environmental contaminants, to develop regulatory standards, and to manage environmental cleanups.

Three complementary areas comprise the health assessment program:

- 1) The Integrated Risk Information System and other priority health assessments,
- 2) Risk assessment guidance, methods, and model development, and
- 3) Integrated Science Assessments of criteria air pollutants.

Integrated Risk Information System (IRIS) and other health hazard assessments: Peer reviewed, qualitative and quantitative health hazard assessments are prepared on environmental pollutants of major relevance to EPA's regulatory mandates. These assessments are used by EPA's Program and Regional Offices to support their decision-making, and they are also disseminated to the public, principally on the IRIS internet database.⁴⁴ IRIS is widely used throughout EPA and the risk assessment/risk management community as the premier source of hazard and dose-response information for environmental pollutants. At the end of 2007, more than 540 health hazard assessments were available through IRIS.

Risk assessment guidance, methods and model development: Improved risk assessment guidance, methods, and models are developed to enhance the quality and objectivity of assessments through the incorporation of contemporary scientific advances for use in decision-making by EPA's Program and Regional Offices. These scientific products are

⁴⁴ Available at: <http://www.epa.gov/iris>.

externally peer reviewed and disseminated through the published literature, EPA web sites, and incorporation in IRIS assessments.

Integrated Science Assessments: Congress requires that EPA regularly summarize the state-of-the-science on the criteria air pollutants – ozone, particulate matter, sulfur and nitrous oxides, carbon monoxide, and lead – to assist EPA’s air and radiation programs in determining the National Ambient Air Quality Standards (NAAQS). These Integrated Science Assessments (formerly Air Quality Criteria Documents) are major risk assessments that undergo rigorous external peer review by the Clean Air Scientific Advisory Committee (CASAC).

This research program is guided by the Human Health Risk Assessment Multi-Year Plan⁴⁵ (MYP), which provides detail on the assessment and methods development products planned under this program. The MYP also outlines research needs and priorities for making decisions central to EPA’s implementation of its statutory responsibilities and to its mission to protect human health and the environment. Performance outputs and outcomes are documented in the MYP through the annual performance goals and measures structure. The MYP also coordinates with a number of EPA research strategies and plans⁴⁶ (e.g., Human Health Research Strategy, Drinking Water MYP, Clean Air MYP) to obtain the information necessary to inform risk assessment outputs and programmatic decision-making needs.

In FY 2003, a Board of Scientific Counselors (BOSC)—a Federal advisory committee comprised of qualified, independent scientists and engineers—subcommittee review found that the National Center for Environmental Assessment (NCEA) has made several key advancements including completion of a strategic plan, targeting cutting-edge risk assessments, enhancing communication, and improving capabilities to provide environmental assessment resources in response to significant events. A subsequent BOSC subcommittee program review began in November 2007. This prospective and retrospective review is evaluating the program’s relevance, quality, performance, and scientific leadership. The BOSC’s evaluation and recommendations will provide guidance to EPA to help plan, implement, and strengthen the program over the next five years.

FY 2009 Activities and Performance Plan:

In FY 2009, the Agency will continue to support IRIS and other health hazard assessments by:

- Completing several health hazard assessments of high priority chemicals for interagency review or external peer review and posting several finalized assessments on the internet; and
- Consulting with the National Academy of Sciences (NAS) on critical risk assessment methods development and assessment approaches.

⁴⁵ Available at: <http://www.epa.gov/osp/bosc/pdf/hhramypdraft.pdf>.

⁴⁶ Available at: <http://www.epa.gov/ord/htm/researchstrategies.htm#rs01>.

In the area of risk assessment guidance, methods and models, the Agency will support improvements in the following areas:

- Approaches for applying mode of action information in risk assessments;
- Approaches for characterizing risks to susceptible populations;
- Approaches for characterizing environmental exposures for use in risk assessments;
- Approaches to quantification (e.g., PBPK and BBDR modeling, categorical regression, meta analysis approaches);
- Variability and uncertainty analysis (e.g., Bayesian and other approaches);
- Approaches for applying cumulative risk assessment principles to health assessments (e.g., whole mixture and component based approaches)

In FY 2009, the Agency will support the NAAQS process:

- Developing and implementing a process to identify, compile, characterize, and prioritize new scientific studies for “Integrated Science Assessments” of criteria air pollutants, as a mandated prerequisite to EPA’s review of the NAAQS and to effectively meet court ordered deadlines to provide these assessments; and
- Delivering final Ecological Integrated Science Assessments for Particulate Matter, for the NO_x/SO_x secondary standards, and for Carbon Monoxide (draft) to contribute to EPA’s Air and Radiation program’s review of the NAAQS and creation of state-of-the-science methods for continuous evaluation of assessments of new scientific information on criteria air pollutants.

These continued investments will allow the human health risk assessment (HHRA) program to make significant progress toward its long-term goals, providing state-of-the-science health hazard assessment information. The work supports risk assessment models, methods, and guidance to inform decisions and actions to protect human health from risks posed by environmental pollutants.

The Office of Management and Budget (OMB) rated the HHRA program as “moderately effective” in a 2006 Program Assessment Rating Tool (PART) review, which was conducted under the program title “Human Health Risk Assessment.”⁴⁷ This “moderately effective” rating was attributed to the fact that the program had long-term, annual, and efficiency measures in place and that the program exhibited strong financial management and budget-performance integration. In response to OMB recommendations following the 2006 PART, the program is currently 1) expanding its efficiency measures, 2) developing and implementing revisions to the IRIS review process, 3) investigating alternative approaches for measuring progress related to providing timely, high quality scientific assessments, and 4) instituting regular independent program reviews. The program has taken action on each of these recommendations. For example, for a BOSC review that began in November 2007, it developed a BOSC charge including questions to evaluate HHRA's effectiveness and relevance to key risk management decisions. The program also is examining how best to expand its efficiency measure to ensure consistency with other approaches being developed across EPA’s Research and Development

⁴⁷ For more information, see <http://www.whitehouse.gov/omb/expectmore/detail/10004308.2006.html>

program. In 2008, the program will improve the IRIS prioritization process. Accordingly, the program will revise its performance measure and targets to more appropriately capture relative priorities of assessments.

Performance Targets:

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Efficiency	Average cost to produce Air Quality Criteria/Science Assessment documents.	5,533	5,386	3,796	4,235	Average Cost in Dollars

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of Air Quality Criteria/Science Assessment documents.	100	90	90	90	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of HHRA health assessments*.	100	90	90	90	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Outcome	Usefulness of HHRA's Air Quality Criteria Documents (AQCDs), represented by the number of days between the completion of AQCD peer review and publication of the EPA staff document that relies on AQCD	68	106	90	90	Days

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of HHRA	100	90	90	90	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
	Technical Support Documents.					

*Currently, the 2009 planned outputs include delivering 16 health hazard assessments to interagency or external peer review.

The research conducted under this program supports EPA Strategic Objective 4.4. Specifically, the program identifies and synthesizes the best available scientific information, models, methods, and analyses to support Agency guidance and policy decisions related to the health of people and communities.

The program gauges its annual and long-term success in meeting this objective by assessing its progress on several key measures. In 2009, the program plans to meet at least 90% of its planned outputs in support of 1) Integrated Science Assessment summaries (formerly Air Quality Criteria Documents), 2) HHRA Health Assessments (completing health hazard assessments of high priority chemicals for interagency review or external peer review and posting finalized assessments on the internet), and 3) HHRA Technical Support Documents.

The program is re-examining its productivity and efficiency measures in response to expected feedback from its recent BOSC review and the National Academy of Sciences study of the best approaches for measuring the efficiency of research.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (+\$58.0) This reflects an increase for payroll and cost of living for all FTE.
- (-\$270.0 / -3.7 FTE) This reflects a reduction in funding for lower priority research on risk assessment methods, such as research supporting the revision of inhalation reference concentration (RfC) methodologies.
- (+\$1,201.0 / +0.2 FTE) This change reflects restoration of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs. These funds also will be used in support of risk assessment research.

Statutory Authority:

CAA; SDWA; CWA; TSCA; FIFRA; CERCLA; SARA; FQPA; ERDDA.

Human Health Risk Assessment

Program Area: Research: Human Health and Ecosystems

Goal: Healthy Communities and Ecosystems

Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
Science & Technology	\$35,018.0	\$38,856.0	\$38,334.0	\$39,323.0	\$989.0
<i>Hazardous Substance Superfund</i>	<i>\$3,926.4</i>	<i>\$3,972.0</i>	<i>\$3,910.0</i>	<i>\$3,325.0</i>	<i>(\$585.0)</i>
Total Budget Authority / Obligations	\$38,944.4	\$42,828.0	\$42,244.0	\$42,648.0	\$404.0
Total Workyears	176.3	182.1	182.1	178.6	-3.5

Program Project Description:

The Human Health Risk Assessment (HHRA) program provides health hazard assessments and develops assessment methods. It supports Superfund in the following areas:

The Integrated Risk Information System (IRIS)¹⁴, Provisional Peer-Reviewed Toxicity Values (PPRTVs), and other health hazard assessments: Based on the expressed needs of EPA’s Solid Waste and Emergency Response program, this program prepares IRIS hazard characterization and dose-response profiles for environmental pollutants of specific relevance to site assessments and remediation. Where IRIS values are unavailable, the HHRA program develops PPRTVs for evaluating chemical specific exposures at Superfund sites. Support for these PPRTV assessments is provided through the Superfund Technical Support Centers.

Risk assessment guidance, methods, and model development: Improving risk assessment guidance, methods, and models to support Superfund includes the development of exposure-response data arrays, revised RfC methodology and cumulative risk tools to better estimate potential effects of exposures at Superfund sites on humans and the consultative support necessary for the application of these methods.

Superfund research is guided by the long term *Waste Research Strategy*¹⁵, which was developed with participation from major clients and outlines research needs and priorities. These research efforts are guided by multi-year plans (MYPs)¹⁶, developed with input from across the Agency, including scientific staff in the Superfund program and the Regional offices. The MYPs outline

¹⁴ Available at: <http://www.epa.gov/iris>.

¹⁵ U.S. EPA, Office of Research and Development, *Waste Research Strategy*. Washington, D.C.: EPA. For more information, see <http://www.epa.gov/ord/htm/documents/wastepub.pdf>.

¹⁶ For more information, see <http://www.epa.gov/osp/myp>.

The *Waste Research Strategy* outlines the research needs and priorities at the time it was prepared. To guide these research efforts as progress is made and new needs emerge, EPA develops multi-year research plans that are revised periodically. EPA is currently merging the Contaminated Sites and RCRA Multi-Year Plans (MYPs) into one cohesive Land Research MYP, with input from across the Agency, to ensure research conducted continues to support the Agency’s mission to protect human health and the environment.

steps for meeting the needs of Agency programs and for evaluating progress through annual performance goals and measures. Application of the research results and existing published scientific information to risk assessment needs is described in the HHRA MYP¹⁷.

In FY 2003, a Board of Scientific Counselors (BOSC)—a Federal advisory committee comprised of qualified, independent scientists and engineers—subcommittee review found that the National Center for Environmental Assessment (NCEA) had made several key advancements including completion of a strategic plan, targeting cutting-edge risk assessments, enhancing communication, and improving capabilities to provide environmental assessments resources in response to significant events. A subsequent BOSC subcommittee program review began in November 2007. This prospective and retrospective review is evaluating the program’s relevance, quality, performance, and scientific leadership. The BOSC’s evaluation and recommendations will provide guidance to EPA to help plan, implement, and strengthen the program over the next five years.

FY 2009 Activities and Performance Plan:

In FY 2009, the HHRA program (FY 2009 Request, \$3.3 million) will continue to directly support key elements of EPA’s Strategic Plan relating to Superfund - particularly the characterization of risks, reduction of contaminant exposures, and cleanup of contaminated sites (FY 2009 Request, \$3 million). Risk assessment activities relevant to Superfund cleanups will include:

- Continuing to work toward the completion of IRIS health hazard assessments for high priority chemicals found at multiple Superfund sites and thereby contributing to decision-making needs for Superfund and other Agency programs (also supported by HHRA under the Science and Technology appropriation);
- Completing 50 new or renewed Provisional Peer Reviewed Toxicity Values (PPRTV) at the request of the Solid Waste and Emergency Response program, and providing health hazard evaluations, provisional reference doses/concentrations (pRfD/Cs), and/or cancer slope factors for priority pollutants to support Agency risk assessments;
- Preparing a draft update of the Exposure Factors Handbook for external review, collating exposure information for use in Superfund site assessments (also supported by HHRA in the Science and Technology appropriation); and
- Providing technical support to Superfund site and program managers on human health risk assessment through the Superfund Technical Support Centers.

The Office of Management and Budget (OMB) rated the program as “moderately effective” in a 2006 Program Assessment Rating Tool (PART) review, which was conducted under the program title “Human Health Risk Assessment.”¹⁸ This “moderately effective” rating was attributed to the fact that the program had long-term, annual, and efficiency measures in place, and that the

¹⁷ Available at: <http://www.epa.gov/osp/bosc/pdf/hhramypdraft.pdf>.

¹⁸ For more information, see <http://www.whitehouse.gov/omb/expectmore/detail/10004308.2006.html>

program exhibited strong financial management and budget-performance integration. In response to OMB recommendations following the 2006 PART, the program is currently 1) expanding its efficiency measures, 2) developing and implementing revisions to the IRIS review process, 3) investigating alternative approaches for measuring progress related to providing timely, high quality scientific assessments, and 4) instituting regular independent program reviews. The program has taken action on each of these recommendations. For example, for a BOSC review that began in November 2007, it developed a BOSC charge including questions to evaluate HHRA's effectiveness and relevance to key risk management decisions. The program also is examining how best to expand its efficiency measure to ensure consistency with other approaches being developed across the Research and Development program and is discussing ways to improve the IRIS prioritization process with OMB.

Performance Targets:

The research conducted under this program supports EPA Strategic Objective 4.4. Specifically, the program identifies and synthesizes the best available scientific information, models, methods, and analyses to support Agency guidance and policy decisions related to the health of people and communities.

The program gauges its annual and long-term success in meeting this objective by assessing its progress on several key measures. In 2009, the program plans to meet at least 90% of its planned outputs in support of 1) HHRA Health assessments and 2) HHRA Technical Support Documents.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (+\$76.0) This reflects an increase for payroll and cost of living for existing FTE.
- (-\$730.0) This reflects a reduction in funding for lower priority research on exposure assessments. This may delay support for science-based decision making in EPA's regulatory and cleanup programs.
- (+\$69.0) This change reflects restoration of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs.

Statutory Authority:

SWDA; HSWA; SARA; CERCLA; ERDDA.

Research: Computational Toxicology Program/Project by Research Area

(Dollars in Millions)

	FY 2004 Enacted		FY 2005 Enacted		FY 2006 Enacted		FY 2007 Enacted		FY 2008 President's Budget		FY 2008 Enacted ¹		FY 2009 President's Budget		FY 2009 vs. FY 2008 Enacted	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
ORD Long-Term Goal																
Predictive Tools	\$11.8	23.0	\$12.0	24.1	\$12.3	36.8	\$14.7	34.3	\$15.1	34.3	\$12.1	34.3	\$14.9	32.7	\$2.8	(1.6)
Total	\$11.8	23.0	\$12.0	24.1	\$12.3	36.8	\$14.7	34.3	\$15.1	34.3	\$12.1	34.3	\$14.9	32.7	\$2.8	(1.6)

Note: Includes estimates of workforce support costs

¹ Reflects estimate of the FY 2008 Enacted.

Research: Computational Toxicology

Program Area: Research: Human Health and Ecosystems

Goal: Healthy Communities and Ecosystems

Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
<i>Science & Technology</i>	<i>\$12,159.5</i>	<i>\$15,103.0</i>	<i>\$12,135.0</i>	<i>\$14,863.0</i>	<i>\$2,728.0</i>
Total Budget Authority / Obligations	\$12,159.5	\$15,103.0	\$12,135.0	\$14,863.0	\$2,728.0
Total Workyears	35.7	34.3	34.3	32.7	-1.6

Program Project Description:

Computational Toxicology is the application of mathematical and computer models to assess the risk chemicals pose to human health and the environment. Computational biology offers the possibility that, with advances in computational biology's sub-disciplines (e.g., genomics, proteomics, and metabonomics), scientists may have the ability to develop a more detailed understanding of the risks posed by a much larger number of chemicals while reducing the use of animals during toxicological testing.

EPA's Computational Toxicology Research Program (CTRP) has three long term goals: 1) improving the linkages in the source-outcome paradigm; 2) providing tools for screening and prioritization of chemicals under regulatory review; and 3) enhancing quantitative risk assessment. The National Center for Computational Toxicology (NCCT) was specifically created to play a critical coordination and implementation role in these activities across the Agency. The strategic directions of CTRP are highly consistent with the report recently released by the National Research Council entitles "Toxicity Testing in the Twenty-first Century: A Vision and a Strategy" (NRC, 2007).

The Agency has developed a peer-reviewed *Framework for a Computational Toxicology Research Program*,⁴⁸ which identifies the research needs and unique capabilities of EPA and provides the basis for a more focused and integrated research program in the future. This research effort also supports *Understanding Complex Biological Systems*, one of the Administration's FY 2008 R&D priorities.

A subcommittee of EPA's Board of Scientific Counselors (BOSC)—a Federal advisory committee comprised of qualified, independent scientists and engineers— has been established to provide guidance to the newly formed NCCT. In April 2005, this subcommittee met to review the proposed directions for the NCCT. Their report is available on the BOSC web site at <http://www.epa.gov/osp/bosc/subcomm-ctox.htm>. The report praised the early efforts of the NCCT and encouraged its further development. A formal response was prepared and submitted

48 U.S. EPA, Office of Research and Development. *A Framework for a Computational Toxicology Research Program*. Washington, DC: EPA. Accessed August 4, 2005. Available at: http://www.epa.gov/comptox/publications/comptoxframework06_02_04.pdf.

to EPA and the BOSC. The BOSC expressed strong support for the program's 2006-2008 Implementation Plan and ongoing research of the CTRP in their 2006 review (see http://www.epa.gov/comptox/bosc_review/2006/index.html). A recent review of the program by the BOSC held in December 2007 focused specifically on the topics of information management, high throughput screening, dose response models for arsenic, and the virtual liver programs. Preliminary comments at the review suggested strong support for this seminal work.

FY 2009 Activities and Performance Plan:

Consistent with the research *Framework* and program implementation plans, the CTRP will focus in three key areas in FY 2009: 1) information technology; 2) chemical prioritization and categorization tools; and 3) systems biology models. Greater emphasis will be placed on using systems biology based approaches to advance health-based assessments.

Information Technology: New technologies are needed to mine existing data for patterns to appropriately place new chemicals of unknown hazard in the context of existing data. In addition, new technologies will allow the integration of data from different domains of toxicology and newer "omics" data. In FY 2009, the Distributed Structure-Searchable Toxicity Database project (DSSTox) will begin expanding involvement of data generation efforts with the 1) ToxCast program, a chemical prioritization project being developed by NCCT; 2) the National Toxicology Program, an interagency program within the Department of Health and Human Services, whose mission is to evaluate agents of public health concern by developing and applying tools of modern toxicology and molecular biology; and 3) high-throughput screening techniques, a system to rapidly and efficiently test large batches of chemicals for bioactivity utilizing robotics and automation applied to molecular biology and assay methods. Efforts also will include collaboration with European counterparts. The DSSTox project will be an important structure-annotated and structure-searchable summary toxicity data conduit to other toxicology systems in this program. In addition, a data management system, Aggregated Computational Toxicology Resource (ACToR), is being developed to handle the needs of the CTRP program, including ToxCast, DSSTox, and virtual liver. This system will consist of several databases and computer applications for data access and analysis. In FY 2009 and beyond, the ACToR system will begin to integrate other types of quantitative biological and toxicological data on chemicals.

Chemical Prioritization and Categorization Tools: Having the capability to predict which chemicals are in greatest need of toxicology testing and which endpoints would be the most important to examine is a pressing problem for multiple regulatory offices in EPA. Knowledge of the key steps in a chemical's potential mechanisms of action provides a template for developing models for these predictions.

The ToxCastTM program is a multi-component effort launched in FY 2007. As a result of this research the Agency is obtaining high-throughput screening data on 320 chemicals of known toxicological profiles. More than 400 endpoints are being generated on each chemical through nine research contracts and one Interagency Agreement (with the National Institutes of Health (NIH) Molecular Libraries Initiative at the National Chemical Genomics Center). Fingerprints of biological activity associated with differing toxicological profiles will be developed from this database. The ToxCast approach is highly consistent with the recent recommendations of the National Research Council for a transformation in toxicology involving modern biological tools.

In FY 2008, ToxCast™ linkages will be expanded as the US has the lead role in OECD's Molecular Screening Initiative that will bring a number of international partners into the research program. In FY 2008 and beyond, plans are to begin Phase II of ToxCast™ that will profile the activities of up to 1000 chemicals in order to broaden the chemical diversity used in Phase I and to evaluate the predictive nature of bioactivity signatures developed in that phase. With successful completion of Phase II, ToxCast™ technologies can be applied to chemicals of concern to EPA program offices.

The Agency also will conduct research focusing on molecular modeling to predict and understand chemical toxicity. In FY 2009, the focus will shift towards the consideration of other interaction targets in biological macromolecules such as binding sites in receptors and enzymes that play a role in reactive processes.

Systems Biology Models: Modeling now plays a crucial role in practically all areas of biological research. Systems models integrate information at all levels of organization and aid in bridging the source-to-outcome gap and in conducting quantitative risk assessments. In FY 2009, this research will:

- Provide standards for developing, documenting, archiving, and accessing quantitative mathematical models that will foster both the development and linkages of these models and their regulatory acceptance;
- Utilize systems-modeling approaches for the latest biological, chemical, and exposure data for quantitative risk assessment;
- Develop guidance on best practices for the construction, analysis and reporting of toxicological models that link pharmacokinetic information with the dynamic responses of target organs; and
- Coordinate experimental studies with biologically based dose-response models to understand the low dose effects of arsenic on key biological systems (collaborative effort with the National Health and Environmental Effects Research Laboratory).
- Implement the Virtual Liver Project that will provide (1) a framework that coherently integrates mechanistic information and data to elucidate perturbations induced by chemicals (2) inference tools for extrapolating mechanisms across life stages, species and susceptible populations; and (3) quantitative tools for predicting the risk of adverse outcomes in humans through dynamic simulation (collaborative effort with the National Health and Environmental Effects Research Laboratory).

The research conducted under this program supports EPA Strategic Objective 4.4. Specifically, the program identifies and synthesizes the best available scientific information, models, methods, and analyses to support Agency guidance and policy decisions with a focus on human, community, and ecosystem health.

Performance Targets:

Work under this program supports EPA Strategic Objective 4.4: Enhance Science and Research. Specifically, the program identifies and synthesizes the best available scientific information, models, methods, and analyses to support Agency guidance and policy decisions with a focus on

human, community, and ecosystem health. Currently, there are no performance measures for this specific program.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (+\$2,776.0) This increase supports computational toxicology research. The resources provide the minimum funding necessary to deliver timely, critical research results for the Agency, developing more efficient methods to evaluate chemical toxicity. Such research includes Phase II of ToxCastTM,⁴⁹ which upon successful completion can be applied to chemicals (as an innovative alternative to evaluating chemicals) of concern to EPA program offices. Another important result of this research will be reducing the reliance on the use of animals for toxicity testing.
- (+\$356.0) This reflects an increase for payroll and cost of living for all FTE.
- (-\$404.0 / -1.6 FTE) This change reflects restoration of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs.

Statutory Authority:

TSCA; FIFRA; FQPA; SDWA; ERDA.

⁴⁹ ToxCast is an international recognized pioneering research program using tools developed in the pharmaceutical industry for drug discovery to detect the critical biological targets of chemicals at cost orders of magnitude less than traditional toxicity testing approaches. ToxCast is central to our collaborative efforts with the National Toxicology Program of NIEHS and the NIH Chemical Genomics Center of the National Human Genome Research Institute (NHGRI)

Research: Endocrine Disruptors Program/Project by Research Area

(Dollars in Millions)

ORD Multi-Year Plan ORD Long-Term Goal	FY 2004 Enacted		FY 2005 Enacted		FY 2006 Enacted		FY 2007 Enacted		FY 2008 President's Budget		FY 2008 Enacted ¹		FY 2009 President's Budget		FY 2009 vs. FY 2008 Enacted	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
Endocrine Disrupting Chemicals	\$10.6	53.8	\$10.1	50.3	\$10.2	53.6	\$10.2	53.6	\$9.8	53.2	\$10.0	53.2	\$9.2	48.9	(\$0.8)	(4.3)
EDCs' effects, exposure, assessment and management	\$4.7	22.6	\$5.3	20.3	\$5.3	22.0	\$4.8	22.0	\$4.2	21.8	\$4.4	22.5	\$4.3	21.7	(\$0.1)	(0.8)
Extent of impact of EDCs	\$3.9	16.8	\$2.5	15.4	\$2.5	15.7	\$2.7	15.7	\$2.8	15.6	\$2.6	14.9	\$2.6	14.4	\$0.0	(0.5)
Screening and testing	\$2.0	14.3	\$2.3	14.6	\$2.4	15.9	\$2.7	15.9	\$2.9	15.8	\$2.9	15.8	\$2.3	12.8	(\$0.6)	(3.0)
Human Health	\$0.2	1.2	\$0.3	1.2	\$0.3	1.2	\$0.3	1.2	\$0.3	1.2	\$0.3	1.2	\$0.3	1.2	\$0.0	0.0
Susceptible Subpopulations	\$0.2	1.2	\$0.3	1.2	\$0.3	1.2	\$0.3	1.2	\$0.3	1.2	\$0.0	0.0	\$0.0	0.0	\$0.0	0.0
Cumulative Risk	\$0.0	0.0	\$0.0	0.0	\$0.0	0.0	\$0.0	0.0	\$0.0	0.0	\$0.3	1.2	\$0.3	1.2	\$0.0	0.0
Total	\$10.9	55.0	\$10.4	51.5	\$10.5	54.8	\$10.5	54.8	\$10.1	54.4	\$10.3	54.4	\$9.5	50.1	(\$0.8)	(4.3)

Note: Includes estimates of workforce support costs

¹ Reflects estimate of the FY 2008 Enacted.

Research: Endocrine Disruptor

Program Area: Research: Human Health and Ecosystems

Goal: Healthy Communities and Ecosystems

Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
<i>Science & Technology</i>	<i>\$10,476.7</i>	<i>\$10,131.0</i>	<i>\$10,317.0</i>	<i>\$9,502.0</i>	<i>(\$815.0)</i>
Total Budget Authority / Obligations	\$10,476.7	\$10,131.0	\$10,317.0	\$9,502.0	(\$815.0)
Total Workyears	53.4	54.4	54.4	50.1	-4.3

Program Project Description:

Research in direct support of EPA’s endocrine screening and testing programs (mandated under the Food Quality Protection Act (FQPA) of 1996 and the Safe Drinking Water Act Amendments⁵⁰ (SDWAA) of 1996) evaluates current testing protocols and develops new protocols to evaluate potential endocrine effects of environmental agents. Other research develops and applies methods, models, and measures to evaluate real-world exposures to endocrine disruptors and characterize related effects resulting from these exposures for humans and wildlife; and develops risk management tools to prevent or mitigate exposures. Research assists decision makers in working toward reducing and preventing exposure of humans and ecosystems to endocrine disruptors.

Research is guided by the Research Plan for Endocrine Disruptors, which was developed with participation from major clients and outlines research needs and priorities.⁵¹ The Agency also maintains a multi-year plan (MYP)⁵² for Endocrine Disruptors that outlines steps for meeting these needs, as well as annual performance goals and key research outputs for evaluating progress.

In December 2004, the Endocrine Disruptors research program was reviewed by a subcommittee of EPA’s research advisory committee, the Board of Scientific Counselors (BOSC), which commended the progress and direction of the research and provided recommendations for further partnerships.⁵³ Consistent with BOSC recommendations, EPA will take a leadership role in the application of "omics" technologies (e.g., genomics, proteomics, and metabonomics studies), focusing research on understanding mechanisms of action and extrapolation across species by applying "omics" approaches. In the first mid-cycle review, which began in August 2007, the

⁵⁰ SDWA Section 1457.

⁵¹ U.S. EPA, Office of Research and Development, *Research Plan for Endocrine Disruptors*. Washington, D.C.: EPA (1998). Available at: <http://www.epa.gov/ord/htm/documents/ORD-EDR-Feb1998.pdf>.

⁵² U.S. EPA, Office of Research and Development, *Multi-Year Plan for Endocrine Disruptors*. Washington, D.C.: EPA (2003). Available at: <http://www.epa.gov/osp/myep/edc.pdf>.

⁵³ U.S. EPA, Office of Research and Development, EDC Research Program Review. Washington, D.C. (2004). Available at: <http://www.epa.gov/osp/bosc/pdf/edc0504rpt.pdf>; updated draft 2007 available at: http://www.epa.gov/osp/subcomm-edcs_mid.htm#documents.

subcommittee described the updated draft MYP as “excellent” and indicated that the Program’s progress exceeded its expectations.

FY 2009 Activities and Performance Plan:

In FY 2009, EPA will continue to develop, evaluate, and apply innovative DNA microarray and other state-of-the-art analytical methods for endocrine disrupting chemicals (EDCs). EPA’s Endocrine Disruptors research program has developed and refined assays and improved other screening tools using genomics and high-speed computing capabilities so that the Agency has the necessary protocols to validate for use in the Endocrine Disruptors Screening Program. Using genomics and related approaches in the continued development of improved molecular and computational tools that can help prioritize chemicals for screening and testing will lead to a reduction of animal testing and is within the “Understanding Complex Biological Systems” category highlighted as a priority for Federal investment by the Office of Management and Budget (OMB) and Office of Science and Technology Policy (OSTP)⁵⁴. This research is also consistent with the newly released NAS report on “Toxicity Testing in the Twenty-first Century: A Vision and a Strategy” which recommended that the Agency move toward using new technologies to prioritize and screen for chemicals.⁵⁵ Other important areas of research to be continued in FY 2009 include:

- Developing/improving *in vivo* and *in vitro* assays to provide the Agency the methods it needs to implement the Congressionally mandated Endocrine Disruptor Screening Program – a high priority for the Agency;
- Developing the next generation of assays by applying newer computational and molecular approaches to develop models that predict a chemical’s ability to cause endocrine disruption;
- Determining classes of chemicals that act as endocrine disruptors and their potencies; characterizing modes of action and the shape of the dose-response curve; developing approaches for assessing cumulative risk; and extrapolating results across species which would lead to reduced animal testing;
- Developing molecular indicators of exposure and analytical methods for detecting certain EDCs; identifying the key factors that influence human exposures to EDCs; and identifying sources of EDCs entering the environment, focusing on: wastewater treatment plants, concentrated animal feeding operations (CAFOs), and drinking water treatment plants; developing tools for risk reduction and mitigation strategies; and
- Applying methods, models, and tools developed by EPA and other research organizations to characterize the impact of environmental mixtures of EDCs on environmental media and aquatic organisms. Sources of EDCs to be examined include wastewater treatment plants, CAFOs, and drinking water plants.

The program’s long-term performance measures are: (1) to determine the extent of the impact of endocrine disruptors on humans, wildlife, and the environment to better inform the Federal and scientific communities; and (2) to reduce the uncertainty regarding the effects, exposure,

⁵⁴ FY 2008 Administration Research and Development Budget Priorities memo by J.Marburger and S. McMillin, August 16, 2007.

⁵⁵ National Academies Press (2007). Available at: http://www.nap.edu/catalog.php?record_id=11970#toc.

assessment, and management of endocrine disruptors so that EPA has a sound scientific foundation for environmental decision-making. The research program also has developed performance indicators that monitor research activities and outputs. Targets for these include screening and testing protocols that the Prevention, Pesticides and Toxic Substances program will validate for use in evaluating the potential for chemicals to cause endocrine-mediated effects. To improve performance, the programs are currently working to develop baseline data for efficiency measures that compare dollars and labor hours for validating chemical assays.

OMB rated the research program as “adequate” in its 2004 Program Assessment Rating Tool (PART) review, which was conducted jointly with the Prevention, Pesticides and Toxic Substances program under the title “Endocrine Disruptors.”⁵⁶ This rating was supported by findings that the program was free of major design flaws, had a clear purpose, and was reasonably well-managed. In response to OMB recommendations following the PART, the program has articulated its R&D priorities to ensure compelling, merit-based justifications for funding allocations. Additionally, the Prevention, Pesticides and Toxic Substances program has compiled baseline data for its efficiency measure and continues to collect data to serve as a comparison to its baseline.

Performance Targets:

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Improved protocols for screening and testing	3	6	2	0	Reports

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Effects and exposure milestones met	5	4	5	9	Reports

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Assessment milestones met	0	0	0	0	Reports

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Risk management milestones met	2	3	1	1	Reports

The research conducted under this program supports EPA Strategic Objective 4.4. Specifically, the program identifies and synthesizes the best available scientific information, models, methods, and analyses to support Agency guidance and policy decisions related to the health of people, community, and ecosystems, with a focus on endocrine-active pesticides and toxic chemicals. As a result of the 2004 PART process, the program has developed long-term performance measures. In addition, the research program has developed annual performance indicators that

⁵⁶ For more information, see <http://www.whitehouse.gov/omb/expectmore/summary/10002280.2004.html>

monitor the completion of its key research outputs. These products will ultimately be delivered to the Prevention, Pesticides and Toxic Substances program for evaluating the potential of chemicals to cause endocrine-mediated effects.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (-\$350.0) This reduces additional Congressionally directed funds included in the FY 2008 Omnibus appropriation for research on EDCs.
- (-\$204.0) This decrease is the net effect of increases for payroll and cost of living for existing FTE, combined with a reduction based on the recalculation of base workforce costs.
- (-\$253.0 / -4.3 FTE) The development of validated tiers I and II endocrine disruptor screening protocols will be completed at the end of FY 2008, as announced in the Federal Register in July 2007. In FY 2009, these FTE will be redirected to support high priority investigations of the health effects of asbestos under the Land Protection and Restoration program. This also includes a realignment of resources that provide organization-wide support.
- (-\$8.0) This change reflects the 1.56% rescission to all program projects in addition to technical changes such as realignment of IT, travel or other support costs across programs.

Statutory Authority:

CAA; ERDDA; FIFRA; TSCA; FQPA; SDWA; CWA; RCRA; CERCLA; PPA.

Research: Pesticides and Toxics by Research Area

(Dollars in Millions)

ORD Multi-Year Plan ORD Long-Term Goal	FY 2004 Enacted		FY 2005 Enacted		FY 2006 Enacted		FY 2007 Enacted		FY 2008 President's Budget		FY 2008 Enacted ⁴		FY 2009 President's Budget		FY 2009 vs. FY 2008 Enacted	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
Food Quality Protection Act (FQPA)	\$8.6	34.7	\$1.6	9.1												
FQPA risk assessment ¹	\$8.6	34.7	\$1.6	9.1												
Pollution Prevention	\$0.7	0.0	\$1.7	0.0												
Pollution Prevention Tools ²	\$0.7	0.0	\$1.7	0.0												
Safe Pesticides/Safe Products (SP2)	\$22.5	135.0	\$24.5	130.3	\$30.4	123.4	\$26.0	122.2	\$24.8	126.3	\$24.5	126.3	\$26.6	137.4	\$2.1	11.1
Predictive tools	\$8.5	62.6	\$9.8	57.8	\$12.6	50.3	\$10.1	49.8	\$11.2	55.9						
Wildlife risk assessment	\$6.8	46.9	\$7.2	45.0	\$8.6	46.2	\$8.2	45.8	\$7.7	44.5						
Chemical risk reduction	\$5.1	10.5	\$5.2	12.5	\$5.8	15.7	\$5.8	15.5	\$4.0	15.1						
Evaluation of new hazards	\$2.1	15.0	\$2.3	15.0	\$3.2	11.2	\$1.9	11.1	\$2.0	10.8						
Predictive tools for risk assessment ³											\$3.3	18.2	\$3.6	19.1	\$0.3	0.9
Wildlife risk reduction ³											\$16.2	93.0	\$18.9	104.6	\$2.7	11.6
Biotechnology ³											\$4.9	15.1	\$4.0	13.7	(\$0.9)	(1.4)
Total	\$31.8	169.6	\$27.8	139.5	\$30.4	123.4	\$26.0	122.2	\$24.8	126.3	\$24.5	126.3	\$26.6	137.4	\$2.1	11.1

Note: Includes estimates of workforce support costs

¹ Beginning in FY 2005, resources to support core human health research were shifted from FQPA to Human Health. No adverse impacts as research continued to address FQPA issues.

² Represents resources associated with persistent bioaccumulative toxics (PBTs). In FY 2006, these resources were redirected to support the Advanced Monitoring Initiative.

³ In FY 2009, ORD revised its Long Term Goal structure within the SP2 program. This was made retroactive to the FY 2008 Enacted.

⁴ Reflects estimate of the FY 2008 Enacted.

Research: Pesticides and Toxics

Program Area: Toxic Research and Prevention

Goal: Healthy Communities and Ecosystems

Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
<i>Science & Technology</i>	\$29,425.2	\$24,795.0	\$24,459.0	\$26,568.0	\$2,109.0
Total Budget Authority / Obligations	\$29,425.2	\$24,795.0	\$24,459.0	\$26,568.0	\$2,109.0
Total Workyears	125.5	126.3	126.3	137.4	11.1

Program Project Description:

The Pesticides and Toxics research program is a multidisciplinary program that examines risks resulting from exposure to pesticides and toxic chemicals. The research is designed to support the Agency's efforts to reduce current and future risks to the environment and to humans by preventing and/or controlling the production of new chemicals and products of biotechnology that pose unreasonable risk, as well as assessing and reducing the risks of chemicals and products of biotechnology already in commerce. This research complements work conducted under the Human Health and Ecosystem Research, the Human Health Risk Assessment, and the Endocrine Disruptors Research programs. The development and validation of methods and models and assessments for predicting risks from pesticides, toxic substances, and products of biotechnology to human health and ecosystems are conducted under the Pesticides and Toxics research program.

Research is guided by the Biotechnology Research Strategy⁹⁰ and the Wildlife Research Strategy,⁹¹ both of which were developed with participation from major clients (e.g. EPA's Prevention, Pesticides and Toxic Substances program and the Regional Offices). The strategies outline the research needs and priorities. The Agency also maintains a Safe Pesticides/Safe Products (SP2) multi-year plan (MYP)⁹² that outlines steps for meeting these needs, as well as annual performance goals and measures for evaluating progress.

The program's long-term performance measures rate the utility of its methods, models, and data for use by EPA's Prevention, Pesticides and Toxic Substances program and other organizations. The research program's three major goals are: (1) to provide predictive tools to prioritize testing requirements; enhance interpretation of data to improve human health and ecological risk assessments; and inform decision-making regarding high priority pesticides and toxic substances;

⁹⁰ U.S. EPA, Office of Research and Development. *Biotechnology Research Strategy*. Washington, DC: EPA. Available at: http://www.epa.gov/nheerl/publications/files/biotechnology_research_program_4_8_05.pdf.

⁹¹ U.S. EPA, Office of Research and Development, *Wildlife Research Strategy*. Washington, D.C.: EPA. Available at: http://www.epa.gov/nheerl/publications/files/wildlife_research_strategy_2_2_05.pdf.

⁹² U.S. EPA, Office of Research and Development, *Safe Pesticides/Safe Products Multi-Year Plan*. Washington, D.C.: EPA (2003). Available at: <http://www.epa.gov/osp/myp/sp2.pdf>.

(2) to develop probabilistic risk assessments to protect natural populations of birds, fish, other wildlife, and non-target plants; and (3) to provide the tools necessary to make decisions related to products of biotechnology.

In February 2007, the Pesticides and Toxics research program underwent an external peer review by EPA's research advisory committee, the Board of Scientific Counselors (BOSC), which commended the progress and direction of the research and provided recommendations for improvement.⁹³ The BOSC stated that "SP2 is a very successful program. The research is of high quality and is focused on well-articulated goals. Its relevance to the Agency's mission is clear and apparent, and the SP2 Program fills a unique niche within the Agency, and serves the needs of OPPTS, its major client, very well." The BOSC also noted that, "the scientists involved in these projects are internationally recognized and their findings and organized panels serve to establish regulatory guidance around the world."

FY 2009 Activities and Performance Plan:

In FY 2009, research will continue to provide the scientific foundation for the three major goals of the Pesticides and Toxics research program.

EPA will provide research on methods, models, and data to support prioritization of testing requirements, enhanced interpretation of data to improve human health and ecological risk assessments, and decision-making regarding specific individual or classes of pesticides and toxic substances that are of high priority. This research will develop/validate:

- predictive biomarkers of neurotoxic effects for major classes of pesticides;
- alternative test methods for the hazard identification of developmental neurotoxicants;
- virtual chemical screening methods for risk-based prioritization and ranking needs for chronic non-cancer effects; and
- quantitative structure activity relationships (QSARs) to relate various structural descriptions of molecules to toxicity endpoints.

Research conducted in FY 2009 will support the development of probabilistic risk assessments to protect natural populations of birds, fish, other wildlife, and non-target plants. This research directly supports Agency efforts to assure that endangered species are protected from pesticides while making sure farmers and communities have the pest control tools they need. Four key components of this research are:

- extrapolation among wildlife species and exposure scenarios of concern;
- population biology to improve population dynamics in spatially-explicit habitats;
- models for assessing the relative risk of chemical and non-chemical stressors; and
- models to define geographical regional/spatial scales for risk assessment.

⁹³ U.S. EPA, Office of Research and Development, SP2 Research Program Review. Washington, D.C. (2007). Available at: <http://www.epa.gov/osp/bosc/pdf/sp2072307rpt.pdf>.

Methods for characterization of population-level risks of toxic substances to aquatic life and wildlife also will be developed. Results of this research will help the Agency meet the long-term goal of developing scientifically valid approaches for assessing spatially-explicit, population-level risks to wildlife populations and non-target plants and plant communities from pesticides, toxic chemicals and multiple stressors while advancing the development of probabilistic risk assessment. This supports the Agency's obligation under the Endangered Species Act.

Additionally, EPA will provide biotechnology research to support decision-making related to products of biotechnology, although the scope of the research program will be reduced. Through its Science to Achieve Results (STAR) program, methods are being developed to assess the potential allergenicity of genetically engineered plants.

The Office of Management and Budget (OMB) rated the program as "moderately effective" in a 2007 Program Assessment Rating Tool (PART) review, which was conducted under the program title "Pesticides and Toxics Research."⁹⁴ This rating was attributed to OMB findings that an independent expert review by the BOSC determined the program was effective and achieving results, that the program was very well coordinated with the Prevention, Pesticides and Toxic Substances program, and that the program had long-term and annual performance measures in place. In response to OMB recommendations following the 2007 PART, the program is currently: 1) developing a formal response to the BOSC report, addressing action items, and making progress toward long-term and annual targets, 2) assessing the current efficiency measure to determine how best to capture the cost effectiveness of research activities, and 3) developing a system to utilize quarterly performance measurement reporting to improve program performance.

Performance Targets:

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Efficiency	Percent variance from planned cost and schedule.				-6	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of the SP2 program's long-term goal one.	100	86	100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of the SP2	80	100	100	100	Percent

⁹⁴ For more information, see <http://www.whitehouse.gov/omb/expectmore/summary/10009012.2007.html>.

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
	program's long-term goal three.					

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of the SP2 program's long-term goal two.	100	100	100	100	Percent

The research conducted under this program supports EPA Strategic Objective 4.4. Specifically, the program identifies and synthesizes the best available scientific information, models, methods, and analyses to support Agency guidance and policy decisions related to the health of people, community, and ecosystems, with a focus on pesticides and toxic chemicals.

The program gauges its annual and long-term success in meeting this objective by assessing its progress on several key measures. In 2009, the program strives to complete 100% of its planned outputs in support of its three long-term goals. Additionally, to make improvements in efficiency, the program aims to decrease its variance from planned cost and schedule to -6%, a measure that the National Academy of Sciences is reviewing as part of its study to determine the best approach for measuring the efficiency of research. Achieving these targets will enable the Agency to make well-informed guidance and policy decisions related to pesticides.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (+\$854.0 / +14.3 FTE) This increase is the result of a consolidation of FTE and associated resources from the Human Health and Ecosystems program to support research on spatially explicit exposure assessment tools that integrate data. In particular, wildlife risk assessment will be transferred from the ecosystems research program to the pesticides and toxics program to align with the primary client regulatory program, the Prevention, Pesticides and Toxic Substances program. This also includes a realignment of resources that provide organization-wide support, such as operating expenses and travel.
- (+\$845.0) This reflects an increase for payroll and cost of living for all FTE.
- (+\$1,410.0 / -0.2 FTE) This change reflects restoration of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs. These funds also will be used in support of pesticides and toxics research.
- (-\$1,000.0 / -3.0 FTE) This reduces funding for the Agency's biotechnology research to understand the impact of genetically modified crops on the environment. This reduction would minimize the impact to the highest priority work in the pesticides and toxics

research program, such as research to support the development of probabilistic risk assessment methods.

Statutory Authority:

FQPA; FIFRA; TSCA; CWA; CAA; ERDDA.

**EPA ORD Research Budget Sections For 2009 –
Economics and Sustainability**

- a) **Economics & Decision Sciences**
- b) **Sustainability**

Research: Sustainability Program/Project by Research Area

(Dollars in Millions)

ORD Multi-Year Plan ORD Long-Term Goal	FY 2004 Enacted		FY 2005 Enacted		FY 2006 Enacted		FY 2007 Enacted		FY 2008 President's Budget		FY 2008 Enacted ²		FY 2009 President's Budget		FY 2009 vs. FY 2008 Enacted	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
Pollution Prevention/Sustainability¹	\$43.9	127.2	\$38.6	119.2	\$29.1	80.9	\$23.9	77.3	\$22.5	76.2	\$22.1	76.2	\$20.0	70.8	(\$2.1)	(5.4)
Pollution Prevention Tools	\$19.8	70.6	\$20.4	74.7	\$11.2	34.1	\$9.5	31.6	\$9.6	31.4						
Green Chemistry and Engineering	\$9.3	29.1	\$5.3	23.1	\$6.6	26.8	\$5.0	23.8	\$6.1	23.7						
Environmental Technology Verification (ETV)	\$3.6	6.0	\$3.2	6.0	\$3.0	4.7	\$1.6	7.7	\$2.0	7.7						
Environmental Systems Management	\$3.4	16.5	\$2.1	9.7	\$2.5	9.6	\$2.2	8.9	\$2.2	8.2						
Small Business Innovation Research (SBIR)	\$7.8	5.0	\$7.5	5.7	\$5.8	5.7	\$5.6	5.3	\$2.6	5.2						
Metrics and Indicators ¹											\$6.0	23.9	\$6.0	23.0	\$0.0	(0.9)
Decision Support Tools ¹											\$7.5	29.1	\$6.6	24.6	(\$0.9)	(4.5)
Technology: SBIR; People, Prosperity and the Planet (P3); ETV ¹											\$8.6	23.2	\$7.3	23.2	(\$1.3)	0.0
Socioeconomics³	\$2.6	2.0	\$2.4	3.0	\$2.3	3.0	\$2.3	3.0								
Valuation of health and ecosystem benefits	\$1.0	1.0	\$1.1	1.5	\$0.2	1.5	\$1.2	1.5								
Environmental compliance behavior and decision making	\$1.6	1.0	\$1.4	1.5	\$0.2	1.5	\$0.2	1.5								
Valuation of environment and health					\$1.0	0.0										
Market mechanism and economic incentives					\$0.9	0.0	\$1.0	0.0								
Total	\$46.5	129.2	\$41.0	122.2	\$31.4	83.9	\$26.2	80.3	\$22.5	76.2	\$22.1	76.2	\$20.0	70.8	(\$2.1)	(5.4)

Note: Includes estimates of workforce support costs

¹ In FY 2009, ORD revised its Long Term Goal structure within the Sustainability program. This was made retroactive to the FY 2008 Enacted. In addition, consistent with strategic planning efforts, ORD refocused the program from pollution prevention to sustainability.

² Reflects estimate of the FY 2008 Enacted.

³ In FY 2008, the Economic Decision Sciences/Socioeconomics program was shifted to the Office of Policy, Economics, and Innovation (OPEI).

Research: Sustainability

Program Area: Research: Sustainability

Goal: Compliance and Environmental Stewardship

Objective(s): Enhance Societies Capacity for Sustainability through Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
<i>Science & Technology</i>	<i>\$24,864.5</i>	<i>\$22,478.0</i>	<i>\$22,127.0</i>	<i>\$19,970.0</i>	<i>(\$2,157.0)</i>
Hazardous Substance Superfund	\$212.3	\$0.0	\$0.0	\$0.0	\$0.0
Total Budget Authority / Obligations	\$25,076.8	\$22,478.0	\$22,127.0	\$19,970.0	(\$2,157.0)
Total Workyears	81.4	76.2	76.2	70.8	-5.4

Program Project Description:

EPA’s Science and Technology for Sustainability (STS) program is designed to advance sustainability goals. Sustainable and preventive approaches to health and environmental problems have increasingly become the Agency’s focus since the Pollution Prevention Act of 1990. As defined in the Brundtland Report⁸³, sustainability is development which meets the needs of the present without compromising the ability of future generations to meet their own needs.

Sustainable approaches require: innovative design and production techniques that minimize or eliminate environmental liabilities; integrated management of air, water, and land resources; and changes in the traditional methods of creating and distributing goods and services. In addition to conducting research related to human health and environmental threats, EPA is committed to promoting sustainability—achieving economic prosperity while protecting natural systems and quality of life for the long-term.

The Science Advisory Board’s (SAB) Environmental Engineering Committee reviewed EPA’s Sustainability Research Strategy⁸⁴ and the Science and Technology for Sustainability Multi-Year Plan in June 2006. The SAB stated that it “strongly endorses the Agency’s proposal to establish a research program focused on sustainability because the results from such a program will improve the scientific foundation for a sustainable environment.”⁸⁵ The STS research program contains several new elements, such as the development of metrics and systems-based environmental management practices, as a result of this review. Ongoing efforts include: 1) a multi-disciplinary Sustainable Environmental Systems program; 2) a decision support tools program which has championed the use of life cycle assessment methods and 3) the People, Prosperity, and the Planet (P3) Student Design Competition for Sustainability. In addition, the STS research program was reviewed by EPA’s Board of Scientific Counselors (BOSC) in FY

⁸³ For more information see, <http://habitat.igc.org/open-gates/wced-ocf.htm>

⁸⁴ For more information see, http://www.epa.gov/sustainability/pdfs/EPA-12057_SRS_R4-1.pdf

⁸⁵ For more information see, [http://yosemite.epa.gov/sab%5Csabproduct.nsf/D24960CAEE6ECCAB852572FE00704EC0/\\$File/sab-07-007.pdf](http://yosemite.epa.gov/sab%5Csabproduct.nsf/D24960CAEE6ECCAB852572FE00704EC0/$File/sab-07-007.pdf)

2007 (April 2007). The BOSC will soon release a report on the program's quality and performance.

The STS Research Program is designed to ultimately position EPA's Research and Development program to provide technical support to regional and national sustainability policies and initiatives. Toward this end the STS Research Program has established the following areas of emphasis:

- *Sustainability Metrics:* As sustainable solutions to environmental problems are developed and implemented, there is a need to measure the progress and impact of these efforts. The research in this area is focused on developing scientifically-based sustainability metrics and indices that will provide policy makers and citizens with a suite of measurement tools that are both readily accessible and easily understood. The long-term objective is to develop sustainability metrics for use in a variety of applications, including technology evaluation, regional ecosystem and watershed management and more general measurements that are suitable for use in the Agency's Report on the Environment.
- *Decision Support Tools:*⁸⁶ This research creates tools and methods for use by public and private sector decision makers to support the achievement of sustainable outcomes. This effort is built on the foundation of Life Cycle Analysis (LCA) techniques that address the sustainability of alternative policy options, production pathways, and product usage by describing the full environmental impact of each alternative. This work encompasses both core research (in furthering methods and techniques) and applied research (with tools for specific clients, i.e. TRACI, the Tool for Reduction and Assessment of Chemical and Other Environmental Impacts).
- *Technologies:* This research emphasizes the role that technologies have in creating sustainable outcomes. Through programs such as the Small Business Innovation Research (SBIR) program and the People, Prosperity, and Planet (P3) student design competition, emphasis will be placed on finding solutions to client-driven problems while promoting sustainable design and implementation practices.
 - *Small Business Innovation Research (SBIR) Program:*⁸⁷ As required by the Small Business Act as amended,⁸⁸ EPA sets aside 2.5% of its extramural research budget for contracts to small businesses to develop and commercialize new environmental technologies.
 - *People, Prosperity, and the Planet (P3):*⁸⁹ P3 is a student competition to develop solutions to sustainability challenges. For example, a joint student team from Oberlin College and Brown University created a low-cost system that students

⁸⁶ For more information, see <http://www.epa.gov/ord/NRMRL/std/sab>.

⁸⁷ For more information, see <http://es.epa.gov/ncer/sbir>.

⁸⁸ U.S. Public Law 219, 79th Congress, 2nd session, 22 July 1982. *Small Business Innovation Development Act of 1982*. More information is available at: <http://thomas.loc.gov/cgi-bin/bdquery/z?d097:s.881>.

⁸⁹ For more information, see <http://es.epa.gov/ncer/p3>.

can use to monitor energy and water consumption at various scales, from individual dormitory floors to their entire college campus.

Over the long term, the STS Program will promote and support national and regional sustainability policies and initiatives by ensuring that decision-makers within the EPA and at the local, regional and national levels have a scientifically sound set of management tools that promote stewardship and sustainability outcomes.

FY 2009 Activities and Performance Plan:

In FY 2009, the Science and Technology for Sustainability (STS) research program will continue its focus on sustainability metrics and decision support tools. Some specifics are outlined below.

In the area of sustainability metrics, research in FY 2009 will focus on both technology and systems metrics. An applied technology metrics problem will be initiated to validate in-house research efforts. EPA will continue a project to develop scientifically-based sustainability metrics for use in evaluating innovative technologies. Systems metrics represents the measurement of energetic resources, human health, ecological burden (i.e., water, biota, air), and overall system function and health in a broader regional scale. The San Luis Valley Project will be working on the development and application of a set of five sustainability metrics (ecological and economic) to be used by environmental managers in their efforts to support sustainable outcomes in the San Luis Valley of Colorado. Also, building upon the in-house research effort, the program is beginning research on sustainability metrics for use in future Reports on the Environment.

Planned research in decision support tools includes efforts to further develop a streamlined in-house Life Cycle Assessment methodology and incorporate material flow concepts into these tools. The program will complete an environmental impact assessment model for land use and continue work on a water use model. A collaborative research project applying sustainability metrics to management of regional ecosystems will be established and work will continue on extending an auction-based management approach to urban wet weather flow.

The EPA also will continue to fund the development of new innovative technologies through the P3 program and to advance the development of international environmental technology testing protocols and a global environmental technology network. The Agency will continue to develop a report to document the impact of technology verifications on achieving sustainable outcomes.

In 2003, EPA's sustainability research program, under the program title Research: Pollution Prevention and New Technologies Research, received a "results not demonstrated" in its PART review. The program was rated "results not demonstrated" due to its lack of adequate strategic planning and performance measures. However, EPA has taken steps to address these deficiencies through the development of the Science and Technology for Sustainability Multi-Year Plan as well as annual and long term performance and efficiency measures that will be finalized in consultation with OMB.

Performance Targets:

Work under this program supports EPA's Strategic Plan Objective 5.4: Enhance Science and Research. Currently, there are no PART performance measures for this specific program project. However, the program monitors performance including the timely completion of research milestones and the citation rates of research publications. The program expects to formalize these and other performance measures during Spring 2008. Additionally, the program began implementing a new efficiency measure in 2007 to track the "Percent variance from planned cost and schedule." In response to a PART follow-up action and the recently issued report by The National Academies on "Evaluating Research Efficiency in the U.S. Environmental Protection Agency," EPA plans to review this measure and consult with OMB about how best to measure efficiency going forward.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (-\$1,600.0 / -3.1 FTE) This reflects a reduction to resources for the sustainability program, including the Small Business Innovation Research program. Although work will continue, the reduction will delay the development of metrics to assess new technologies. However, highest priority work, such as the development of easily accessible and understandable sustainability metrics, the sustainability of alternative policy options based on Life Cycle Analysis, and new technologies developed through P3, will continue without delay.
- (+\$464.0) This reflects an increase for payroll and cost of living for existing FTE.
- (-\$471.0) This reduction reflects efficiencies associated with resources that provide organization-wide support, for example, funding for operating expenses, capital equipment, repairs and improvements, and the use of contract resources, and efficiencies associated with IT and telecommunications support resources, including high-performance computing.
- (-\$125.0) This reflects a consolidation of the Agency's program evaluation efforts.
- (-2.3 FTE) This change reflects EPA's workforce management strategy that will help the Agency better align resources, skills and Agency priorities. This is part of a technical realignment of FTE across all programs to reflect programmatic priorities. There are no programmatic or performance impacts.
- (-\$425.0) This change reflects restoration of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs.

Statutory Authority:

CAA; CWA; FIFRA; PPA; RCRA; SDWA; SBA; SARA; TSCA; ERDDA.

Research: Sustainability

Program Area: Research: Sustainability

Goal: Compliance and Environmental Stewardship

Objective(s): Enhance Societies Capacity for Sustainability through Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
Science & Technology	\$24,864.5	\$22,478.0	\$22,127.0	\$19,970.0	(\$2,157.0)
<i>Hazardous Substance Superfund</i>	<i>\$212.3</i>	<i>\$0.0</i>	<i>\$0.0</i>	<i>\$0.0</i>	<i>\$0.0</i>
Total Budget Authority / Obligations	\$25,076.8	\$22,478.0	\$22,127.0	\$19,970.0	(\$2,157.0)
Total Workyears	81.4	76.2	76.2	70.8	-5.4

Program Project Description:

Under the Small Business Research (SBIR) Program²³, as required by the Small Business Act as amended²⁴, EPA sets aside 2.5% of its extramural research budget for contracts to small businesses to develop and commercialize new environmental technologies. SBIR, the only activity contained in this program, will not be funded under the Superfund account at this time.

Performance Targets:

Work under this program supports EPA's Enhance Science and Research objective. Currently, there are no PART performance measures for this specific program.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- The 2.5% set-aside will be identified when the FY 2009 budget is enacted.

Statutory Authority:

CAA; CWA; FIFRA; PPA; RCRA; SDWA; SBA; SARA; TSCA.

²³ For more information, see <http://es.epa.gov/ncer/sbir>.

²⁴ U.S. Public Law 219, 79th Congress, 2nd session, 22 July 1982. *Small Business Innovation Development Act of 1982*. For more information, see <http://thomas.loc.gov/cgi-bin/bdquery/z?d097:s.881>.

EPA ORD Research Budget Sections For 2009 –
Air and global Climate Change

- a) **Global Change**
- b) **Clean Air**

Research: Global Change Program/Project by Research Area

(Dollars in Millions)

ORD Long-Term Goal	FY 2004 Enacted		FY 2005 Enacted		FY 2006 Enacted		FY 2007 Enacted		FY 2008 President's Budget		FY 2008 Enacted ²		FY 2009 President's Budget		FY 2009 vs. FY 2008 Enacted	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
National/Regional Assessment	\$5.4	9.3	\$4.9	9.2	\$5.1	10.0	\$4.7	8.0	\$4.4	8.3						
Air Quality	\$8.5	14.5	\$7.4	14.4	\$7.0	13.4	\$5.9	12.7	\$6.6	13.1						
Ecosystems	\$6.5	14.3	\$6.4	12.2	\$5.7	10.4	\$3.8	11.0	\$3.8	7.5						
Water Quality	\$0.5	2.2	\$0.6	2.1	\$0.5	2.0	\$0.3	2.1	\$0.5	2.2						
Human Health	\$0.3	1.5	\$0.3	1.5	\$0.3	1.4	\$1.5	1.5	\$1.7	1.6						
Climate Change and Air Quality ¹											\$8.8	15.1	\$7.4	14.9	(\$1.4)	(0.2)
Climate Change and Water Quality/Aquatic Ecosystems ¹											\$8.8	13.7	\$7.3	13.6	(\$1.5)	(0.1)
USGCRP Assessments ¹											\$2.0	3.7	\$1.7	3.7	(\$0.3)	0.0
Total	\$21.1	41.8	\$19.6	39.5	\$18.6	37.1	\$16.2	35.3	\$16.9	32.6	\$19.7	32.6	\$16.4	32.2	(\$3.3)	(0.4)

Note: Includes estimates of workforce support costs

¹ In FY 2009, ORD revised its Long Term Goal structure within the Global Change program. This was made retroactive to the FY 2008 Enacted.

² Reflects estimate of the FY 2008 Enacted.

Research: Global Change

Program Area: Research: Clean Air
Goal: Healthy Communities and Ecosystems
Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
<i>Science & Technology</i>	<i>\$20,449.9</i>	<i>\$16,908.0</i>	<i>\$19,688.0</i>	<i>\$16,365.0</i>	<i>(\$3,323.0)</i>
Total Budget Authority / Obligations	\$20,449.9	\$16,908.0	\$19,688.0	\$16,365.0	(\$3,323.0)
Total Workyears	39.2	32.6	32.6	32.2	-0.4

Program Project Description:

EPA’s Global Change research is assessment-oriented, focused on understanding the effects of global change—particularly climate variability and change—on air quality, water quality, aquatic ecosystems, human health and social well-being in the United States. The Agency strives to produce timely and useful information, decision support tools and adaptation strategies that will enable resource managers, policymakers, and other stakeholders to account for global change when making decisions.

The program is also an active participant in the U.S. Climate Change Science Program (CCSP), the interagency Federal effort to improve scientific understanding of climate change.²² EPA’s program priorities are consistent with those of the CCSP, which coordinates and integrates climate change research among 13 Federal departments and agencies, and CCSP’s Strategic Plan,²³ which is being revised. The program also is guided by a multi-year research plan developed by EPA, which is currently under revision.²⁴

A subcommittee of EPA’s Board of Scientific Counselors (BOSC)—a Federal advisory committee comprised of qualified, independent scientists and engineers—conducted a peer review of the program in 2005, and reported that the program “has provided substantial benefits to the nation and that it is on course to make significant further contributions.”²⁵ The subcommittee began a mid-cycle review of the program in January 2008.

²² For more information, see <http://www.climatescience.gov/>.

²³ National Science and Technology Council, *Strategic Plan for the U.S. Climate Change Science Program* (Washington: NSTC, 2003). Available at: <http://climatescience.gov/Library/stratplan2003/>

²⁴ The program’s multi-year plan is currently being revised. The prior plan (2003 version) is available at: <http://www.epa.gov/osp/myr/global.pdf>.

²⁵ U.S. EPA, Board of Scientific Counselors, Subcommittee on Global Change Research, *Review of the Office of Research and Development’s Global Change Research Program at the U.S. Environmental Protection Agency, Final Report*. Washington, D.C.: EPA (2006), 6. See <http://www.epa.gov/osp/bosc/pdf/glob0603rpt.pdf>.

FY 2009 Activities and Performance Plan:

In FY 2009, EPA will be in the final stages of revising its global change multi-year research plan to focus on three long-term goals: (1) understanding how climate change will affect air quality in the United States, (2) understanding how climate change will affect water quality and aquatic ecosystems, and (3) supporting the statutory mandates of the CCSP to produce periodic assessments of the effects of climate change. A component of the first two goals is to provide support to decision makers with areas of responsibility likely to be affected by climate change, such as air quality district managers, state environmental agencies, watershed managers, and operators of waste and drinking water systems. Two key work products planned under the program's new structure are comprehensive assessments of how climate change will affect U.S. air quality and water quality. These assessments will help EPA's Air and Radiation program and Water program, respectively, understand how climate change will affect their ability to meet statutory, regulatory, and programmatic requirements and account for climate change's effects in their future actions.

The U.S. Global Change Research Act of 1990 mandates periodic scientific assessments of the effects of global change.²⁶ Section 106 of the act states that these assessments should integrate and interpret the findings of the Federal government's climate change research; analyze the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; analyze current trends in global change; and project major trends for the next 25 to 100 years. From FY 2006 through FY 2008, EPA will participate in the development of CCSP's Synthesis and Assessments Products (SAPs), serving as lead Agency for three of the 21 assessments.²⁷ Two of the EPA SAPs are among those required to help the CCSP meet the statutory requirements of the 1990 Act. In FY 2009, EPA will continue to participate in CCSP's programmatic, assessment, and planning activities.

The program also will continue decision support efforts by inventorying and assessing the climate-sensitive decisions made by local and state decision makers to identify which decisions are most impacted by climate change and which decisions can benefit most from EPA's scientific findings. A pilot effort in previous fiscal years developed this approach in a specific region of the U.S. (the Chesapeake Bay); in FY 2009, the program will begin to cover the entire country. The results from these assessments will help EPA prioritize its future climate change work.

The program also will develop computer models that simulate how global change may affect U.S. air quality,²⁸ making progress toward its performance goal to complete a framework linking global change to air quality. The program will model and evaluate potential adaptive responses to climate change, such as changes in energy, pollution control, and transportation technologies, and behavior in various regions and sectors of the U.S.²⁹ Together, these efforts will help air

²⁶ See 15 USC §2936.

²⁷ For more information, see <http://www.climatechange.gov/Library/sap/sap-summary.php> .

²⁸ For more information, see <http://www.epa.gov/nerl/goals/global/>.

²⁹ For more information, see <http://www.epa.gov/appcdwww/apb/greengas.htm>.

quality resource managers make informed decisions about how to respond to global change's effects on air quality.

The global change research program makes extensive use of the Science to Achieve Results (STAR) program's competitive, peer-reviewed grants. In FY 2009, STAR's global change component will focus on developing strategies to meet air quality standards that account for future changes in climate and land use, investigating the sensitivity of U.S. water systems to global change, and developing models to quantitatively assess the impacts of global change on water systems.

In FY 2009, the program will shift its environmental and health effects research emphasis to support a comprehensive assessment of how climate change will affect water quality, including aquatic ecosystems. Previous efforts in this area have developed quantitative tools for characterizing the health of coral reefs and studied how changes in water temperature and ultraviolet radiation will affect corals and their symbionts, efforts that led the BOSC to conclude that "the Program is well designed and the researchers have produced important and useful results and products."

The Office of Management and Budget (OMB) rated the Global Change research program as "adequate" in the program's first Program Assessment Rating Tool (PART) review, which was conducted in 2006 under the title "Global Change Research." The rating is attributable primarily to appropriate program purpose and design, strategic planning, program management, and demonstration of some program results. As follow-up actions to the PART, OMB recommended that the program (1) finalize independent, review-informed performance measures; (2) clarify the program's framework and mission; (3) develop a means to measure the program's efficiency; and (4) improve budget-performance integration. In response to these recommendations, the program will begin collecting initial long-term measurement data during its mid-cycle BOSC review in January, 2008, and will collect formal long-term measurement data during its comprehensive BOSC review scheduled for late 2009. Once this baseline information is available, the program will implement new BOSC-informed long-term measures. Additionally, the program is revising its multi-year plan around a clearer framework, and has developed an efficiency measure influenced by earned value management.

Performance Targets:

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered.	100	100	100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percent progress toward completion of a framework linking global change to air quality.	75	75	85	95	Percent

The research conducted under this program supports EPA Objective 4.4. Specifically, the program identifies and synthesizes the best available scientific information, models, methods, and analyses to support Agency guidance and policy decisions related to the health of people, community, and ecosystems, with a focus on global change.

The program gauges its annual and long-term success in meeting this objective by assessing its progress on several key measures. In FY 2009, the program aims to further improve its bibliometric analysis results by (1) increasing the percentage of program publications rated as “highly cited” to 23 percent and (2) increasing the percentage of program publications rated as “high impact” to 24.6 percent. Improvements in these measures demonstrate increased quality and utility of the program’s research. In addition, the program plans to meet 100 percent of its planned outputs, and complete additional work toward a framework linking global change to air quality. By meeting these targets, the research program will improve the Agency’s ability to make guidance and policy decisions related to global change.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (+\$871.0) This reflects an increase for payroll and cost of living for all FTE.
- (-\$3,092.0) This reduction is a result of a Congressionally directed increase included in the FY 2008 Omnibus for support of future rulemaking on greenhouse gases. Funds were provided for research on global climate change research. This schedule is not sustained in the FY 2009 budget request.
- (-\$1,102.0 / -0.4 FTE) This change reflects restoration of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs.

Statutory Authority:

USGCRA; NCPA; ERDDA.

Research: Clean Air Program/Project by Research Area

(Dollars in Millions)

ORD Multi-Year Plan ORD Long-Term Goal	FY 2004 Enacted		FY 2005 Enacted		FY 2006 Enacted		FY 2007 Enacted		FY 2008 President's Budget		FY 2008 Enacted ²		FY 2009 President's Budget		FY 2009 vs. FY 2008 Enacted	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
Particulate Matter	\$56.6	185.9	\$60.9	184.8	\$65.2	182.1	\$64.4	183.1	\$65.2	181.6						
Effects of short-term exposure to particulate matter	\$18.5	62.1	\$19.8	56.4	\$18.6	49.8	\$19.2	50.1	\$20.3	49.7						
Effects of long-term exposure to particulate matter	\$13.6	42.2	\$16.1	47.5	\$17.9	44.8	\$16.4	45.0	\$17.2	44.6						
Implementation of the fine particle NAAQS	\$15.6	59.7	\$16.1	59.1	\$18.7	62.0	\$19.0	62.3	\$18.3	61.8						
Implementation to address residual non-attainment	\$9.0	21.9	\$8.9	21.8	\$10.0	25.5	\$9.8	25.7	\$9.4	25.4						
Tropospheric Ozone	\$5.1	14.3	\$4.0	11.5	\$1.6	8.8	\$1.0	8.8	\$1.3	8.8						
Implementation tools	\$5.1	14.3	\$4.0	11.5	\$1.6	8.8	\$1.0	8.8	\$1.3	8.8						
Air Toxics	\$16.9	59.5	\$17.0	55.6	\$16.2	55.5	\$12.6	52.6	\$14.5	45.8						
Reduce uncertainty in air toxics risks	\$10.9	40.3	\$11.3	35.9	\$9.2	33.1	\$7.9	30.9	\$7.0	23.0						
Implement risk reduction of air toxics	\$6.0	19.3	\$5.7	19.7	\$7.1	22.4	\$4.7	21.7	\$7.5	22.8						
Clean Air¹											\$80.0	236.2	\$80.6	236.4	\$0.6	0.2
Reduce uncertainty in standard setting and air quality management decisions											\$37.9	145.4	\$38.3	146.3	\$0.4	0.9
Assess source-to-health linkages and reduce uncertainty											\$42.1	90.8	\$42.3	90.1	\$0.2	(0.7)
Total	\$78.6	259.7	\$81.9	251.9	\$83.0	246.4	\$78.1	244.5	\$81.1	236.2	\$80.0	236.2	\$80.6	236.4	\$0.6	0.2

Note: Includes estimates of workforce support costs

¹ In FY 2008, the Particulate Matter, Tropospheric Ozone, and Air Toxics MYPs were combined to form the Air MYP.

² Reflects estimate of the FY 2008 Enacted.

Research: Clean Air

Program Area: Research: Clean Air
Goal: Clean Air and Global Climate Change
Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
<i>Science & Technology</i>	<i>\$0.0</i>	<i>\$81,054.0</i>	<i>\$79,993.0</i>	<i>\$80,588.0</i>	<i>\$595.0</i>
Total Budget Authority / Obligations	\$0.0	\$81,054.0	\$79,993.0	\$80,588.0	\$595.0
Total Workyears	0.0	236.2	236.2	236.4	0.2

Program Project Description:

EPA's Clean Air Research Program provides the scientific foundation for the Agency's actions to protect the air all Americans breathe. The program supports the Agency's implementation of the Clean Air Act (CAA), especially the National Ambient Air Quality Standards (NAAQS),⁸ which set limits on how much tropospheric ozone, particulate matter, carbon monoxide, sulfur dioxide, nitrogen oxides, and lead are allowed in the atmosphere.

The program is primarily focused on particulate matter (PM),⁹ but includes research on ozone and hazardous air pollutants, also known as air toxics. The program is guided by a series of National Academy of Sciences (NAS) reports¹⁰ and a multi-year plan that outlines research needs and plans to meet those needs, and establishes milestones for evaluating the program's progress.

The scientific findings from EPA's air research inform the development of Integrated Science Assessments, formerly known as Air Quality Criteria Documents, which are periodic reports that synthesize the science relevant to setting the NAAQS. These assessments are prepared by the Human Health Risk Assessment program and used by EPA's Air and Radiation program to develop and propose revisions to the NAAQS. The program also provides the science necessary to support EPA Regional Offices and state regulatory agencies to identify and design effective strategies to meet the standards. The standard setting and implementation research are also informed by integrated research (*i.e.*, across all media—air, water, and land) on the impacts of climate change and mercury in the Research: Global Change and Research: Human Health and Ecosystems programs respectively.

A subcommittee of EPA's Board of Scientific Counselors (BOSC)—a Federal advisory committee comprised of qualified, independent scientists and engineers—conducted a peer review of the particulate matter and tropospheric ozone research programs in calendar year 2005.

⁸ For more information, see <http://www.epa.gov/air/criteria.html>.

⁹ For more information, see <http://www.epa.gov/pmresearch/>.

¹⁰ The most recent report is: NRC, *Research Priorities for Airborne Particulate Matter: IV. Continuing Research Progress*. Washington, D.C.: National Academies Press (2004). See <http://books.nap.edu/catalog/10957.html>.

The subcommittee also conducted a mid-cycle review of the program in September 2007, and noted in their draft report that "...the quality of the science was high, [and] that it was relevant to Agency and user clients. It was felt that the science was also highly informative to the science community itself, and that there was evident progress and Program evolution with the advancement of the respective science fields."¹¹

FY 2009 Activities and Performance Plan:

In FY 2008, EPA integrated its air research activities around a multi-pollutant approach. This reorganization was guided by recommendations from the NAS and the BOSC, as well as the emerging research needs of EPA's Air and Radiation program. Also, a revised multi-year research plan has recently been completed. The long-term goals of the integrated program are to improve the Agency's setting of air quality standards, such as the NAAQS; air quality management decisions by parties such as air resource boards and the states, which implement the Clean Air Act; and to improve the understanding of how different sources of air pollution, via atmospheric transportation and transformation, result in human exposure and health effects, such as pulmonary and cardiovascular disease, as well as other noncancer and cancer outcomes. The program will increasingly focus on how to address specific sectors contributing to air pollution in a more holistic manner, with the goal of more effective and efficient strategies.

In FY 2009, EPA's Clean Air Research program will continue to study Americans' exposure to air pollution, and the links between sources of pollution and health outcomes.¹² The program will develop computer models of emissions and the atmosphere, which are used to forecast air quality at local and national scales; predict public exposure to air pollutants; and assist states in developing and validating plans to meet the requirements of the Clean Air Act. The program also will study atmospheric chemistry, such as emission mixtures and the formation of secondary pollutants through in-atmosphere reactions; develop ambient air sampling techniques; and conduct research to correlate ambient measurements of emissions with both their sources and with levels of human exposure.

The program's exposure research will emphasize development of a framework for assessing the effectiveness of air pollution regulations and control strategies. EPA will continue its research to understand air pollution near roads.¹³ In collaboration with the Federal Highways Administration (FHWA), the program will focus on topics such as measuring and characterizing emissions near roads; understanding the health effects from those pollutants; and characterizing the effectiveness of low-cost mitigation options.

The integrated program will continue research to inform Agency, state and tribal air quality managers about the sources of air pollution and methods for managing emissions.¹⁴ It will investigate and apply advanced methods to measure the quantity and chemical composition of airborne toxics and particulate matter emissions from human-made and natural sources. These data support development of improved emission inventories, which provide essential data for

¹¹ The final report will be available at: <http://www.epa.gov/osp/bosc/reports.htm>

¹² For more information, see <http://www.epa.gov/nerl/goals/air/>.

¹³ For more information, see <http://www.epa.gov/nerl/goals/air/linkages.html>.

¹⁴ For more information, see <http://www.epa.gov/appedwww/>.

trend analysis, Regional, and local scale air quality modeling, regulatory strategies and impact assessments, and human exposure modeling.¹⁵ These methods also support source apportionment, which traces pollutants measured in ambient air to specific sources based on chemical or structural markers in the pollutants that are unique to certain sources. The program also will generate emission samples from various sources for use in exposure and toxicology studies to understand how health effects vary by source, and develop and evaluate the cost and performance of technologies capable of reducing emissions.

EPA will continue collaborate with the Department of Commerce's National Oceanic and Atmospheric Agency (NOAA), to develop advanced air quality models that simulate transport and fate of pollutants in the atmosphere. These models are used by EPA and NOAA, state and local governments, and the general air pollution research and monitoring community to understand and forecast the location, composition and magnitude of air pollutants, and to develop effective emission control policies and regulations. In the BOSC evaluation, the program was commended for the strong relationships it has established with other funding organizations. The research collaboration and coordination supported by the FY 2009 budget request will ensure that the scientific and technical needs of the Air Research Program continue to be met with minimal duplication of effort.

Further, the Agency will continue epidemiological, clinical, and toxicological studies of air pollution's health effects.¹⁶ Research will focus on determining how the toxicity of particles differs by particle size and chemical composition; understanding how emissions from different sources affect health; the degree to which genes, lifestyle, age, and diseases like diabetes and asthma affect susceptibility to air pollution; and understanding the mechanisms inside the human body by which air pollution causes harm. EPA also will investigate air pollution's effects on cardiopulmonary, nervous, reproductive, and immune systems and on development during pregnancy and infancy. The program also will conduct epidemiological studies of communities with single emission sources or industrial sectors to improve understanding of how health endpoints are connected to distinct sources of air pollution. In FY 2009, a priority area for the program's health effects research will be improving scientific understanding of how particle size influences particulate matter-associated health effects.

The program makes extensive use of the Science to Achieve Results (STAR) program's competitive, peer-reviewed grants.¹⁷ In FY 2009, STAR will continue to fund five-year grants to multi-disciplinary particulate matter research centers at five universities.¹⁸ STAR also will continue to fund a ten-year grant (the largest in EPA's history) to the Multi-Ethnic Study of Atherosclerosis–Air Pollution Study,¹⁹ which is examining links between long-term exposure to particulate matter and heart attacks and strokes in 8,700 volunteers in six states, as well as a five-year grant to the Health Effects Institute,²⁰ a nonprofit research organization cosponsored by EPA and the automotive industry to conduct independent research on the health effects of air

¹⁵ For more information, see <http://www.epa.gov/ttn/chief/eiinformation.html>.

¹⁶ For more information, see <http://www.epa.gov/nheerl/research/cleanair.html>.

¹⁷ For more information, see: <http://es.epa.gov/ncer/science/pm/>.

¹⁸ For more information, see <http://cfpub.epa.gov/ncer/abstracts/index.cfm/fuseaction/outlinks.centers/centerGroup/19/>.

¹⁹ For more information, see <http://depts.washington.edu/mesaair/>.

²⁰ For more information, see <http://www.healtheffects.org/>.

pollution. The program also will fund grants to develop “dynamic” air quality management tools so that local and state air quality managers can adapt emission control plans to changing circumstances in near-real time.

The Office of Management and Budget (OMB) rated the Research: NAAQS program as “adequate” in the program’s second Program Assessment Rating Tool (PART) review, which was conducted in calendar year 2005 under the program title “National Ambient Air Quality Standards Research.”²¹ This rating demonstrates improvement from the program’s previous review—conducted in calendar year 2003—in which OMB rated it “results not demonstrated.” The improvement in score is attributable primarily to the finalization of two long-term goals toward which the program commits to work: (1) reducing uncertainty in the science that supports standard-setting and air quality management decisions and (2) assessing the links between sources of air pollution and health outcomes. In response to OMB’s recommendations following the 2005 review, the program is currently improving integration of its financial and performance data, developing and finalizing methods for measuring progress toward the program’s annual and long-term measures, and implementing annual program reviews which will be completed in June 2008. The program also adopted a measure of its efficiency based on an earned value management concept.

Performance Targets:

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of NAAQS program publications rated as highly cited papers	32.9	35.7	No Target Established*	33.9	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percent progress toward completion of a hierarchy of air pollutant sources based on the risk they pose to human health.	UD	No Target Established	50	70	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percent planned actions accomplished toward the long-term goal of reducing uncertainty in the science that support standard setting and air quality management	100	100	100	100	Percent

²¹ For more information, see <http://www.whitehouse.gov/omb/expectmore/summary.10001137.2005.html>.

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
	decisions.					

*No FY 2008 target was established because targets are set every two years.

The research conducted under this program supports EPA Strategic Objective 1.6. Specifically, the program provides sound science to support EPA’s goal of clean air by conducting leading-edge research and developing a better understanding and characterization of human health and environmental outcomes.

The program gauges its annual and long-term success by assessing its progress on several key measures. In FY 2009, the program strives to complete 100 percent of its planned actions related to the long-term goal of reducing uncertainty in the science that supports standard setting and air quality management decisions. Additionally, the program plans to complete additional work toward a hierarchy of pollutant sources based on the linkages between source emissions and the concentration of pollutants in ambient air, and the risk they pose to human health. Feedback from the ongoing BOSC review is being used to refine this approach heading into FY 2009.

The program’s bibliometric measure, which assesses the quality and impact of its scientific publications compared to other publications in the same field, demonstrates that the programs’ publications are "highly cited" 3.3 times more than other publications. In FY 2009, the program aims to further increase its percentage of “highly cited” publications to 33.9 percent. Achieving these ambitious targets will ensure EPA continues to make significant progress toward providing the research needed to meet its long-term clean air goals.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (+\$1,754.0) This reflects an increase for payroll and cost of living for all FTE.
- (+\$116.0 / –0.4 FTE) This change reflects restoration of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs.
- (-\$1,150.0) This reflects a reduction in research that supports air quality standard setting and links sources of emissions to human exposure to air pollutants and their health endpoints. It includes reduced funding for the Science to Achieve Results (STAR) grants program to conduct research on particulate matter (*i.e.*, soot) that would inform EPA’s Air and Radiation program, which sets limits on the amount of particulate matter legally allowed in the air. In the context of the larger research program and considering the growing challenges the Agency faces, this reduction would minimize the impact to the highest priority work in the air research program, such as studying emission sources, investigating human exposure to air pollutants, developing methods to manage emissions, and investigating air pollutants health effects.
- (-\$125.0 / +0.6 FTE) This reflects the net result of realignments of travel, general expense, and contract resources and shifts of FTE between the air, human health and

ecosystems, land protection and restoration, drinking water, and computational toxicology research programs to align with programmatic priorities.

Statutory Authority:

CAA; ERDDA.

**EPA ORD Research Budget Sections For 2009 –
Technology**

- a) **Land Preservation**
- b) **Nanotechnology**
- c) **GEOSS/Advanced Monitoring Initiative
(AMI)**

Research: Land Preservation and Restoration Program/Project by Research Area

(Dollars in Millions)

ORD Multi-Year Plan ORD Long-Term Goal	FY 2004 Enacted		FY 2005 Enacted		FY 2006 Enacted		FY 2007 Enacted		FY 2008 President's Budget		FY 2008 Enacted ²		FY 2009 President's Budget		FY 2009 vs. FY 2008 Enacted	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
Contaminated Sites	\$33.6	98.5	\$31.1	96.0	\$25.6	93.5	\$23.0	92.0	\$21.6	90.9						
Contaminated Sediments	\$7.9	26.9	\$7.8	26.3	\$7.3	24.0	\$7.4	27.2	\$6.3	26.9						
Ground Water	\$5.3	10.8	\$4.9	9.4	\$5.2	11.6	\$5.3	15.5	\$4.9	15.3						
Soils/Land	\$3.8	14.4	\$3.6	13.8	\$2.3	5.8	\$1.0	5.6	\$1.1	5.6						
Multi-media ³	\$16.6	46.4	\$14.7	46.5	\$10.8	52.1	\$9.3	43.6	\$9.3	43.1						
Hazardous Wastes	\$9.4	47.9	\$9.1	48.2	\$11.6	51.6	\$10.4	50.8	\$10.7	50.4						
RCRA Corrective Action Support	\$0.6	4.0	\$0.0	0.0	\$0.0	0.0	\$0.0	0.0	\$0.0	0.0						
Waste Management	\$2.7	12.3	\$2.6	12.6	\$5.2	18.6	\$3.6	18.3	\$4.3	18.9						
Multi-Media Decision Making	\$6.2	31.6	\$6.4	35.6	\$6.4	33.0	\$6.8	32.5	\$6.4	31.5						
Land¹											\$31.9	141.3	\$35.5	154.7	\$3.6	13.4
Land Restoration											\$21.3	90.9	\$22.1	95.9	\$0.8	5.0
Materials Management and Emerging Issues											\$10.6	50.4	\$13.4	58.8	\$2.8	8.4
Total	\$43.1	146.4	\$40.2	144.2	\$37.2	145.1	\$33.4	142.8	\$32.4	141.3	\$31.9	141.3	\$35.5	154.7	\$3.6	13.4

Note: Includes estimates of workforce support costs

¹ In FY 2009, ORD revised its Long Term Goal structure within the Land program. This was made retroactive to the FY 2008 Enacted.

² Reflects estimate of the FY 2008 Enacted.

³ Contains the Superfund Innovative Technology Evaluation (SITE) program, which was discontinued in FY 2007.

Research: Land Protection and Restoration

Program Area: Research: Land Protection

Goal: Land Preservation and Restoration

Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
<i>Science & Technology</i>	<i>\$10,907.3</i>	<i>\$10,737.0</i>	<i>\$10,591.0</i>	<i>\$13,350.0</i>	<i>\$2,759.0</i>
Leaking Underground Storage Tanks	\$657.0	\$660.0	\$650.0	\$413.0	(\$237.0)
Oil Spill Response	\$841.3	\$901.0	\$887.0	\$704.0	(\$183.0)
Hazardous Substance Superfund	\$23,859.1	\$20,081.0	\$19,768.0	\$21,021.0	\$1,253.0
Total Budget Authority / Obligations	\$36,264.7	\$32,379.0	\$31,896.0	\$35,488.0	\$3,592.0
Total Workyears	134.1	141.3	141.3	154.7	13.4

Program Project Description:

Research performed under the Land Research program supports scientifically defensible and consistent decision-making for Resource Conservation and Recovery Act (RCRA) material management, corrective action, and emerging materials. Research under this program has been evolving from waste disposal to beneficial re-use, avoidance of more toxic materials, and operation of waste management to conserve capacity and produce energy. To address emerging material management issues a strategic shift in the research program was made to focus on nanomaterial fate and transport. Research within this program addresses resource conservation and material reuse issues, the application of models and tools to support the Brownfield program, application of alternative landfill covers and the benefits of landfill bioreactors.

Research efforts are guided by the Land Research Program Multi-Year Plan (MYP)⁷⁷, developed with input from across the Agency, which outlines steps for meeting the needs of the Research and Development program's clients and for evaluating progress through annual performance goals and measures. Specific human health risk and exposure assessments and methods are discussed and conducted under the Human Health Risk Assessment program.

The Land Protection and Restoration research program was externally reviewed by EPA's Board of Scientific Counselors (BOSC)—a Federal advisory committee comprised of qualified, independent scientists and engineers—in FY 2006 (December 2005). The BOSC found that the program generates high quality products and conducts appropriately focused multi-disciplinary research, and “the research conducted...is making its way to end users.”⁷⁸ The BOSC recommended increased focus on emerging issues and the strategic priority of nanomaterial

⁷⁷ EPA, Office of Research and Development, *Land Research Program*. Washington, D.C.: EPA. For more information, see <http://www.epa.gov/osp/myr.htm#land>

⁷⁸ BOSC Land Restoration and Preservation Research Subcommittee Report. For more information, see <http://www.epa.gov/OSP/bosc/pdf/land0603rpt.pdf>

environmental and human health issues. Additional suggestions from both the SAB review and the BOSC review also are being incorporated into the research program.

FY 2009 Activities and Performance Plan:

EPA will continue to collaborate with the private sector to conduct field sampling of contaminated sites. In addition, EPA will work with states to optimize operations and monitoring of several landfill bioreactors and determine their potential to provide alternative energy in the form of landfill gas while increasing the nation's landfill capacity. The BOSC evaluation found that this research, which directly contributes to the Land Restoration long-term goal, "will help states and facility owners pursue R & D permitting of these forward-thinking land disposal options." Recovering landfill space by accelerating waste degradation is an alternative approach to meeting EPA's Solid Waste and Emergency Response program's draft strategic target of decreasing landfill disposal and incineration by 11 million tons. The Agency works with the Association of State and Tribal Solid Waste Management Officials (ASTSWMO) to assist in the communication of research results on landfill bioreactors to the states.

Revitalization of previously used land (e.g., Brownfields) does not always occur due to obstacles related to real and/or perceived contamination. EPA will continue to develop a site specific management approach for brownfields and develop validated acceptable practices for land revitalization. This includes development of GIS and Remote Sensing tools to inventory Brownfield sites as well as publishing the updated SMARTe 2009 edition decision support tool.

In response to BOSC recommendations, EPA has shifted work under this program to address nanotechnology research (FY 2009 Request, \$14.9 million, including \$2.7 million in the Land research program and \$11.8 million in the Human Health and Ecosystem research program), including fate and transport research issues. The primary objective, for nanotechnology fate and transport research, will be to determine the physicochemical properties controlling the movement of nanomaterials through soil and aquatic ecosystems. Research questions include the identification of system parameters that alter the surface characteristics of nanomaterials through aggregation (e.g., pH effects), complexation (e.g., surface complexation by dissolved organic carbon) or changes in oxidation state (e.g., chemical- or biological-mediated electron transfer). Lifecycle issues will also be addressed as part of the broader EPA research efforts into nanotechnology.

The Agency's efforts are coordinated with other Federal agencies through the National Nanotechnology Initiative (NNI),⁷⁹ which the Administration has identified as a FY 2009 research and development budget priority.⁸⁰ EPA's nanotechnology research also is guided by the EPA white paper⁸¹ and EPA's Research and Development programs Nanotechnology Research Strategy.

⁷⁹ For more information, see <http://www.nano.gov/>.

⁸⁰ Executive Office of the President, Office of Management and Budget and Office of Science and Technology Policy, *FY 2008 Administration Research and Development Budget Priorities*. Washington, D.C.: OMB (2006), 5. See <http://www.whitehouse.gov/omb/memoranda/fy2006/m06-17.pdf>.

⁸¹ Environmental Protection Agency, *Nanotechnology White Paper* (Washington: EPA, 2006). Available at: <http://www.epa.gov/osa/nanotech.htm>.

The Office of Management and Budget (OMB) rated the program as “adequate” in its 2006 (PART) review, which was conducted under the program title “Land Protection and Restoration Research.”⁸² This “adequate” rating was supported by findings that the program had long-term and annual output performance measures in place that reflected the purpose of the program, as well as a strong strategic and evaluation approach. In response to OMB recommendations following the 2006 PART, the program has established a process by which the BOSC will assign a performance rating to each program long-term goal as part of its reviews. These ratings will provide the data for new program long-term outcome measures that will be instated. Using the progress rating expected from the 2008 BOSC review, the program will be able to set appropriate future year targets. Additionally, to address OMB’s recommendation that the program establish an outcome-oriented efficiency measure, EPA has initiated a National Academy of Sciences (NAS) study to determine the most appropriate approach. Further, to improve its collection of partner performance information, EPA’s Research and Development program is updating its Policy and Procedures Manual on Extramural Resources Management to require that all research and development grants, contracts, and cooperative agreements be linked to one or more Multi-Year Plan Long-Term Goals (LTGs).

Performance Targets:

Work under this program supports EPA’s Objective 3.3: Enhance Science and Research. Specifically, the program provides and applies sound science for protecting and restoring land by conducting leading-edge research, which, through collaboration, leads to preferred environmental outcomes. Performance measures for this specific program project are included under the Superfund Land Protection and Restoration program.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (+\$1,192.0) This reflects an increase for payroll and cost of living for all FTE.
- (+\$400.0) This reflects an increase in resources to advance the timetable to achieve goals identified in the ORD Nanomaterial Research Strategy. The primary objective of research conducted is to determine the release points of engineered nanomaterials into the environment and the physico-chemical properties controlling the transport and transformation of nanomaterials in environmental media. This will provide the basis for prioritizing potential human health and ecological exposure pathways that warrant further investigation.
- (+\$817.0 / +9.4 FTE) This reflects a redirection of work years and resources from the Water Quality and Human Health research programs to support nanotechnology research, provide research support for the scientific workforce within the land program and a realignment of support workyears to reflect programmatic priorities.

⁸² For more information, see <http://www.whitehouse.gov/omb/expectmore/summary/10004305.2006.html>

- (+\$350.0 / -1.0 FTE) This change reflects restoration of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs.

Statutory Authority:

SWDA; HSWA; ERDDA; SARA; CERCLA; RCRA; OPA; BRERA.

Research: Land Protection and Restoration

Program Area: Research: Land Protection

Goal: Land Preservation and Restoration

Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
Science & Technology	\$10,907.3	\$10,737.0	\$10,591.0	\$13,350.0	\$2,759.0
<i>Leaking Underground Storage Tanks</i>	<i>\$657.0</i>	<i>\$660.0</i>	<i>\$650.0</i>	<i>\$413.0</i>	<i>(\$237.0)</i>
Oil Spill Response	\$841.3	\$901.0	\$887.0	\$704.0	(\$183.0)
Hazardous Substance Superfund	\$23,859.1	\$20,081.0	\$19,768.0	\$21,021.0	\$1,253.0
Total Budget Authority / Obligations	\$36,264.7	\$32,379.0	\$31,896.0	\$35,488.0	\$3,592.0
Total Workyears	134.1	141.3	141.3	154.7	13.4

Program Project Description:

Leaking underground storage tanks (LUSTs) research addresses assessment and cleanup of leaks for fuels and various fuel additives, including methyl tertiary butyl ether (MTBE). Assessment focuses on development of source term and transport modeling modules that can be applied by state project managers. Remediation research addresses multiple remediation approaches applicable to spilled fuels, with or without oxygenates.

These research efforts are guided by the Land Multi-Year Plan (MYP)³, developed with input from across the Agency, which outlines steps for meeting the needs of Agency programs and for evaluating progress through annual performance goals and measures. Specific human health risk and exposure assessments and methods are discussed and conducted under the Human Health Risk Assessment program.

The Land Protection and Restoration research program was externally reviewed by EPA's Board of Scientific Counselors (BOSC)—a Federal advisory committee comprised of qualified, independent scientists and engineers—in FY 2006 (December 2005). The BOSC found that the program generates high quality products and conducts appropriately focused multi-disciplinary research.⁴

FY 2009 Activities and Performance Plan:

Leaking underground storage tanks (LUSTs) assessment research will focus on the development of online transport models that can be used by state project managers. Remedies being

³ EPA, Office of Research and Development, Land Research MYP. Washington, D.C.: EPA. For more information, see <http://www.epa.gov/osp/myrp.htm#land>

⁴ BOSC Land Restoration and Preservation Research Subcommittee Report. For more information, see <http://www.epa.gov/OSP/bosc/pdf/land0603rpt.pdf>

investigated include active water treatment and monitored natural attenuation, with performance influenced by the nature of the fuel oxygenate.

The Office of Management and Budget (OMB) rated the program as “adequate” in its 2006 (PART) review, which was conducted under the program title “Land Protection and Restoration Research.”⁵ This “adequate” rating was supported by findings that the program had long-term and annual output performance measures in place that reflected the purpose of the program, as well as a strong strategic and evaluation approach. In response to OMB recommendations following the 2006 PART, the program has established a process by which the BOSC will assign a performance rating to each program long-term goal as part of its reviews. These ratings will provide the data for new program long-term outcome measures that will be instated. Using the progress rating expected from the 2008 BOSC review, the program will be able to set appropriate future year targets. Additionally, to address OMB’s recommendation that the program establish an outcome-oriented efficiency measure, EPA’s Research and Development program has initiated a National Academy of Sciences (NAS) study to determine the most appropriate approach. Further, to improve its collection of partner performance information, EPA’s Research and Development program is updating its Policy and Procedures Manual on Extramural Resources Management to require that all research and development grants, contracts, and cooperative agreements be linked to one or more Multi-Year Plan Long-Term Goals (LTGs).

Performance Targets:

Work under this program supports EPA’s Strategic Plan Objective 3.3: Enhance Science and Research. Specifically, the program provides and applies sound science for protecting and restoring land by conducting leading-edge research, which, through collaboration, leads to preferred environmental outcomes. Performance measures for this specific program project are included under the Superfund Land Protection and Restoration program.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (+\$81.0) This reflects an increase for payroll and cost of living for existing FTE.
- (-\$280.0) This reduction discontinues a fuel composition study for use in assessing potential contamination problems from leaking underground storage tanks, and studies on the effectiveness of *ex-situ* biotreatment.
- (-\$38.0) This change reflects restoration of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs.

Statutory Authority:

BRERA; CERCLA; ERDDA; HSWA; OPA; RCRA; SARA; SWDA.

⁵ For more information, see <http://www.whitehouse.gov/omb/expectmore/summary/10004305.2006.html>

Research: Land Protection and Restoration

Program Area: Research: Land Protection

Goal: Land Preservation and Restoration

Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
Science & Technology	\$10,907.3	\$10,737.0	\$10,591.0	\$13,350.0	\$2,759.0
Leaking Underground Storage Tanks	\$657.0	\$660.0	\$650.0	\$413.0	(\$237.0)
<i>Oil Spill Response</i>	<i>\$841.3</i>	<i>\$901.0</i>	<i>\$887.0</i>	<i>\$704.0</i>	<i>(\$183.0)</i>
Hazardous Substance Superfund	\$23,859.1	\$20,081.0	\$19,768.0	\$21,021.0	\$1,253.0
Total Budget Authority / Obligations	\$36,264.7	\$32,379.0	\$31,896.0	\$35,488.0	\$3,592.0
Total Workyears	134.1	141.3	141.3	154.7	13.4

Program Project Description:

Land protection research in the oil spills area focuses on three aspects: test protocol development, fate and transport modeling, and remediation. EPA develops and uses these protocols for testing various spill response product classes to pre-qualify products as required by the preparedness and response requirements of the Oil Pollution Act of 1990.

Research is guided by the by the Land Multi-Year Plan (MYP)³, developed with input from across the Agency, which outlines steps for meeting the needs of Agency programs and for evaluating progress through annual performance goals and measures. Testing products ensures that they work as claimed and provides access to effective means to reduce damage when an oil spill occurs. Specific human health risk and exposure assessments and methods are discussed and conducted under the Human Health Risk Assessment program.

The Land Protection and Restoration research program was externally reviewed by EPA’s Board of Scientific Counselors (BOSC)—a Federal advisory committee comprised of qualified, independent scientists and engineers—in FY 2006 (December 2005). The BOSC found that the program generates high quality products and conducts appropriately focused multi-disciplinary research.⁴

FY 2009 Activities and Performance Plan:

Remediation research continues on advances associated with physical, chemical, and biological risk management methods for petroleum and non-petroleum oils spilled into freshwater and marine environments as well as development of a protocol for testing solidifiers and treating oil.

³ EPA, Office of Research and Development, Land Research MYP. Washington, DC: EPA. For more information, see

⁴ BOSC Land Restoration and Preservation Research Subcommittee Report. For more information, see <http://www.epa.gov/OSP/bosc/pdf/land0603rpt.pdf>

Research products are presented at meetings and posted or linked on EPA's oil spills web site for use by oil spill managers.

The Office of Management and Budget (OMB) rated the program as "adequate" in its 2006 (PART) review, which was conducted under the program title "Land Protection and Restoration Research."⁵ This "adequate" rating was supported by findings that the program had long-term and annual output performance measures in place that reflected the purpose of the program, as well as a strong strategic and evaluation approach. In response to OMB recommendations following the 2006 PART, the program has established a process by which the BOSC will assign a performance rating to each program long-term goal as part of its reviews. These ratings will provide the data for new program long-term outcome measures that will be instated. Using the progress rating expected from the 2008 BOSC review, the program will be able to set appropriate future year targets. Additionally, to address OMB's recommendation that the program establish an outcome-oriented efficiency measure, EPA's Research and Development program has initiated a National Academy of Sciences (NAS) study to determine the most appropriate approach. Further, to improve its collection of partner performance information, the Research and Development program is updating its Policy and Procedures Manual on Extramural Resources Management to require that all research and development grants, contracts, and cooperative agreements be linked to one or more Multi-Year Plan Long-Term Goals (LTGs).

Performance Targets:

Work under this program supports EPA's Strategic Plan Objective 3.3: Enhance Science and Research. Specifically, the program provides and applies sound science for protecting and restoring land by conducting leading-edge research, which, through collaboration, leads to preferred environmental outcomes. Performance measures for this specific program project are included under the Superfund Land Protection and Restoration program.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (+\$15.0) This reflects an increase for payroll and cost of living for existing FTE.
- (-\$200.0) This reduction discontinues an oil spill dispersant study and further work on the ERO3s model for predicting migration of contaminants from oil spills. This reduction will eliminate the planned model development to link ERO3s to existing EPA water quality and hydrodynamic models.
- (+\$2.0) This change reflects restoration of the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs.

Statutory Authority:

SWDA; HSWA; SARA; CERCLA; RCRA; OPA; BRERA.

⁵ For more information, see <http://www.whitehouse.gov/omb/expectmore/summary/10004305.2006.html>

Research: Land Protection and Restoration

Program Area: Research: Land Protection

Goal: Land Preservation and Restoration

Objective(s): Enhance Science and Research

(Dollars in Thousands)

	FY 2007 Actuals	FY 2008 Pres Bud	FY 2008 Enacted	FY 2009 Pres Bud	FY 2009 Pres Bud v. FY 2008 Enacted
Science & Technology	\$10,907.3	\$10,737.0	\$10,591.0	\$13,350.0	\$2,759.0
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Oil Spill Response	\$841.3	\$901.0	\$887.0	\$704.0	(\$183.0)
<i>Hazardous Substance Superfund</i>	<i>\$23,859.1</i>	<i>\$20,081.0</i>	<i>\$19,768.0</i>	<i>\$21,021.0</i>	<i>\$1,253.0</i>
Total Budget Authority / Obligations	\$36,264.7	\$32,379.0	\$31,896.0	\$35,488.0	\$3,592.0
Total Workyears	134.1	141.3	141.3	154.7	13.4

Program Project Description:

The Land Research Program provides essential research to EPA’s Superfund program and Regional Offices to enable them to accelerate scientifically defensible and cost-effective decisions for cleanup at complex contaminated sites. Research themes include: contaminated sediments, ground water, and multi-media issues. The research program also provides site-specific technical support through EPA labs and centers, as well as liaisons located in each Regional Office. As such, this program is a vital component of EPA’s efforts to reduce and control risks to human health and the environment.

Research within this program is responsive to the Superfund law requirements under Section 209(a) of Pub. L. 99-499, which states “...a comprehensive and coordinated Federal program of research, development, demonstration, and training for the purpose of promoting the development of alternative and innovative treatment technologies that can be used in response actions under the CERCLA program.” These research efforts are guided by the Land Research Program Multi-Year Plan (MYP)¹⁹ which outlines steps for meeting the needs of Agency programs and for evaluating progress through annual performance goals and measures. Specific human health risk and exposure assessments and methods are conducted under the Human Health Risk Assessment program.

The Land Protection and Restoration research program was externally reviewed by EPA’s Board of Scientific Counselors (BOSC)—a Federal advisory committee comprised of qualified, independent scientists and engineers—in FY 2006 (December 2005). The BOSC found that the

¹⁹ EPA, Office of Research and Development, Land Research Program MYP. Washington, DC : EPA. For more information, see

program generates high quality products and conducts appropriately focused multi-disciplinary research.²⁰

FY 2009 Activities and Performance Plan:

In FY 2009, research will continue to advance EPA's ability to accurately characterize the transport and uptake of chemicals from contaminated sediments and determine the range and scientific foundation for remedy selection options by improving site characterization, monitoring the effectiveness of remediation and evaluation of novel remedial options. This work directly supports the program's long term goal for the mitigation, management and long-term stewardship of contaminated sites. Documented remediation methods and data are vital to developing new cost-effective methods for managing high-cost decisions at controversial, extensively contaminated sites. Continuing work that the BOSC evaluation found is "being developed in a timely way to characterize contaminated sediments accurately and quickly... [and is] sought actively by clients to achieve contaminant cleanups quickly," the contaminated sediments research integrates exposure models, ecological effects and remediation research in order to improve the understanding of best management practices related to Superfund sites. Consistent with the National Research Council's report, "Sediment Dredging at Superfund Megsites: Assessing the Effectiveness,"²¹ EPA will continue the development of alternative sediment remedies with the potential to be more effective than conventional dredging.

In addition, research aimed at developing data to support dosimetric and toxicologic assessment of amphibole asbestos fiber-containing material from Libby, Montana will be conducted. This effort would address key data gaps and provide tools for quantitative characterization, including a comparative analysis of the toxicity of amphibole asbestos-contaminated vermiculite from Libby, Montana relative to other asbestos fibers and asbestos-like mineral occurrences.

The transport of contaminants in ground water and the subsequent intrusion of contaminant vapors into buildings is a critical research issue for EPA's Superfund remediation programs. Work is ongoing to develop reliable soil gas sampling methodologies and to improve vapor intrusion modeling capability. In FY 2009, a report on the vertical distribution of volatile organic compounds (VOC's) from the groundwater to soil will be released to be used as an analytical remediation tool. Permeable reactive barriers (PRB) and the potential expansion of this technology from the treatment of chlorinated organic compounds to inorganic compound will be a major research effort. PRBs are a technology to replace pump and treat methods. Research efforts will also address monitored natural attenuation, specific contamination issues for metals, and treatment of dense non-aqueous phase liquids (DNAPLs).

Research under the multi-media theme includes the development of analytical methods, field sampling guidance, statistical software, monitoring and remediation technologies for mining sites and technical support infrastructure needed to move the products of these research and development activities from the lab and into the hands of site managers and other decision makers. In 2009, immunoassay studies are planned in order to compare techniques that will

²⁰ BOSC Land Restoration and Preservation Research Subcommittee Report. For more information, see <http://www.epa.gov/OSP/bosc/pdf/land0603rpt.pdf>

²¹ For more information, see <http://www8.nationalacademies.org/onpinews/newsitem.aspx?RecordID=11968>

allow rapid on-site characterization of contaminant concentration profiles at the Superfund sites. EPA will continue to provide technical support to Superfund project managers via technical support centers (TSCs) and two modeling assistance web sites that provide site-specific technical support to more than 100 cleanup program sites in the form of responses to scientific questions (e.g., engineering and ground water issues) and technology transfer products to EPA program offices and other stakeholders. TSCs provide information based on research results to increase the speed and quality of Superfund cleanups and reduce associated cleanup costs. Development of human health toxicity values and technical support activities are discussed and conducted under the Human Health Risk Assessment Program.

The Office of Management and Budget (OMB) rated the program as “adequate” in its 2006 PART review, which was conducted under the program title “Land Protection and Restoration Research.”²² This “adequate” rating was supported by findings that the program had long-term and annual output performance measures in place that reflected the purpose of the program, as well as a strong strategic and evaluation approach. In response to OMB recommendations following the 2006 PART, the program has established a process by which the BOSC will assign a performance rating to each program long-term goal as part of its reviews. These ratings will provide the data for new program long-term outcome measures that will be instated. Using the progress rating expected from the 2008 BOSC review, the program will be able to set appropriate future year targets. Additionally, to address OMB’s recommendation that the program establish an outcome-oriented efficiency measure, EPA has initiated a National Academy of Sciences (NAS) study to determine the most appropriate approach. Further, to improve its collection of partner performance information, EPA’s Research and Development program is updating its Policy and Procedures Manual on Extramural Resources Management to require that all research and development grants, contracts, and cooperative agreements be linked to one or more Multi-Year Plan Long-Term Goals (LTGs).

Performance Targets:

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Efficiency	Avg. time (in days) for technical support centers to process and respond to requests for technical document review, statistical analysis and evaluation of characterization and treatability study plans		30.5	29	28	Days

²² For more information, see <http://www.whitehouse.gov/omb/expectmore/summary/10004305.2006.html>

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of the managed material streams, conserve resources and appropriately manage waste long-term goal.	100	100	100	100	Percent

Measure Type	Measure	FY 2007 Actual	FY 2007 Target	FY 2008 Target	FY 2009 Target	Units
Output	Percentage of planned outputs delivered in support of the mitigation, management and long-term stewardship of contaminated sites long-term goal.	100	100	100	100	Percent

Work under this program supports EPA's Strategic Plan Objective 3.3: Enhance Science and Research. Specifically, the program provides and applies sound science for protecting and restoring land by conducting leading-edge research, which, through collaboration, leads to preferred environmental outcomes.

In 2009, the program plans to accomplish its goals of completing and delivering 100 percent of its planned outputs. Additionally, the program plans to meet its efficiency goal of reducing to 28 days its technical support centers' average time for processing and responding to requests for technical document review, statistical analysis, and the evaluation of characterization and treatability study plans. These measures address the increasing utility of EPA research tools and technologies as well as the reduction of uncertainty due to utilization of research and development methodologies, models, and statistical designs. In achieving the performance targets, the program will contribute to EPA's goal of applying sound science in the protection and restoration of land.

FY 2009 Change from FY 2008 Enacted Budget (Dollars in Thousands):

- (+\$1,293.0) This reflects an increase for payroll and cost of living for all FTE.
- (+\$336.0 / +5.0 FTE) This increase reflects support for the asbestos research program. The Libby asbestos action plan has been driven by concern for the health effects of Libby amphibole. The research and development portion of the Libby asbestos action plan has been peer reviewed both externally and internally, and research which has a short time

line is being initiated, as the goal is to provide input into the risk characterization by 2011.

- (-\$688.0) A portion of this reduction will discontinue superfund technical support for site-specific characterization, modeling, monitoring, assessment and remediation of contaminated sites. There also will be delays in developing a framework for modeling fate and transport of contaminants, however, this work will continue.
- (+\$312.0) This change reflects the 1.56% rescission to all program projects in addition to small technical changes such as realignment of IT, travel or other support costs across programs. The increase will support higher priority work, such as contaminated sediments research to develop alternative sediment remedies and permeable reactive barrier technology, in the land protection and restoration research program.

Statutory Authority:

SWDA; HSWA; SARA; CERCLA; RCRA; OPA; BRERA.

ORD Nanotechnology Research by Program/Project

EPA Program/Project	FY 2004 Enacted		FY 2005 Enacted		FY 2006 Enacted		FY 2007 Enacted		FY 2008 President's Budget		FY 2008 Enacted ¹		FY 2009 President's Budget		FY 2009 vs. FY 2008 Enacted	
	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE	\$M	FTE
Research: Human Health and Ecosystems	\$4.0	0.0	\$5.0	0.0	\$3.9	0.0	\$8.2	3.6	\$8.2	3.6	\$8.1	3.6	\$11.8	7.6	\$3.7	4.0
Research: Sustainability	\$0.6	3.0	\$0.6	3.0	\$0.6	3.0	\$0.2	1.0	\$0.2	1.0	\$0.2	1.0	\$0.2	1.0	\$0.0	0.0
Research: Clean Air							\$0.2	1.0	\$0.2	1.0	\$0.2	1.0	\$0.2	1.0	\$0.0	0.0
Research: Land Protection and Restoration									\$1.6	16.0	\$1.9	16.0	\$2.7	23.2	\$0.8	7.2
Total	\$4.6	3.0	\$5.6	3.0	\$4.5	3.0	\$8.6	5.6	\$10.2	21.6	\$10.4	21.6	\$14.9	32.8	\$4.5	11.2

Note: Nanotechnology research cuts across ORD's budget structure; the resources in this table are included in other programs' budget trend tables. Includes estimates of workforce support costs

¹ Reflects estimate of the FY 2008 Enacted.

EPA Science To Achieve Results (STAR) Program Funding
(Dollars in Thousands)

Program / Project	FY 2004 Enacted	FY 2005 Enacted ¹	FY 2006 Enacted ²	FY 2007 Enacted	FY 2008 Pres. Bud.	FY 2009 Pres. Bud.	Change from FY08 P.B. to FY09 P.B.
Research: Computational Toxicology	\$2,417.9	\$3,390.8	\$3,317.1	\$3,363.6	\$3,411.6	\$3,412.0	\$0.4
Research: Drinking Water	\$3,576.4	\$4,455.2	\$4,432.4	\$4,494.8	\$4,558.6	\$4,559.0	\$0.4
Research: Economics and Decision Sciences	\$0.0	\$0.0	\$1,970.6	\$1,975.0	\$0.0	\$0.0	\$0.0
Research: Endocrine Disruptors	\$2,660.4	\$400.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Research: Fellowships	\$9,536.0	\$9,239.7	\$9,280.8	\$7,633.0	\$5,875.0	\$5,875.0	\$0.0
Research: Global Change	\$6,738.9	\$6,685.7	\$6,532.9	\$6,627.8	\$6,321.5	\$6,321.0	(\$0.5)
Research: Human Health and Ecosystems	\$37,552.1	\$27,510.4	\$24,510.0	\$22,822.3	\$23,589.6	\$23,393.0	(\$196.6)
Research: Land Protection and Restoration	\$2,684.1	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Research: NAAQS	\$0.0	\$0.0	\$16,687.6	\$16,922.9	\$0.0	\$0.0	\$0.0
Research: Particulate Matter	\$13,020.9	\$15,830.6	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Research: Clean Air	\$0.0	\$0.0	\$0.0	\$0.0	\$17,163.7	\$16,664.0	(\$499.7)
Research: Pesticides and Toxics	\$998.8	\$979.1	\$957.0	\$970.3	\$984.3	\$985.0	\$0.7
Research: Pollution Prevention	\$5,155.9	\$2,074.4	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Research: Sustainability	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
Research: Water Quality	\$1,132.4	\$947.1	\$925.2	\$942.2	\$0.0	\$0.0	\$0.0
Total	\$85,473.8	\$71,513.0	\$68,613.6	\$65,751.9	\$61,904.3	\$61,209.0	(\$695.3)

¹ Includes resources for endocrine disruptors research allocated to the STAR program after the operating plan was approved.

² Reflects FY 2006 Enacted 0.476% rescission and additional 1% reduction.